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November 15, 2011

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SUBJECT: START 3, EPA Region 8, Contract No. EP-W-05-050, TDD No. 1105-09,
Field Sampling Plan for a Removal Assessment of the Smurfit-Stone Mill, near
Missoula, Missoula County, Montana.

Dear Ms. Ackerman:

Attached is one copy of the final Field Sampling Plan for a Removal Assessment (RA) of the Smurfit-Stone Mill, near Missoula, Missoula County, Montana. An electronic copy of the plan was sent to Robert Parker of the EPA on October 21, prior to the commencement of fieldwork. The electronic copy did not include Appendix A (benchmarks), which is incorporated in this copy.

This document is submitted for your review and signature. If you have any questions, please call me at 303-291-8212.

Very truly yours,

URS OPERATING SERVICES, INC.



Jeff Miller
Project Manager

cc: Charles W. Baker/UOS (w/o attachment)
Jeff Miller/UOS
File/UOS

START 3

Superfund Technical Assessment and Response Team 3 –
Region 8



United States
Environmental Protection Agency
Contract No. EP-W-05-050

**FIELD SAMPLING PLAN
for a
REMOVAL ASSESSMENT**

**SMURFIT-STONE MILL
Near Missoula, Missoula County, Montana**

TDD No. 1105-09

October 21, 2011



URS

OPERATING SERVICES, INC.

In association with:

**Garry Struthers Associates, Inc.
LT Environmental, Inc.
TechLaw, Inc.
Tetra Tech EMI
TN & Associates, Inc.**

FIELD SAMPLING PLAN
for a
REMOVAL ASSESSMENT
at the
SMURFIT-STONE MILL
Near Missoula, Missoula County, Montana

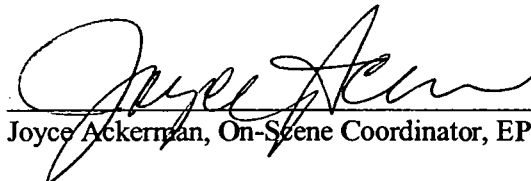
(CERCLIS ID #: MTN000802850)

EPA Contract No. EP-W-05-050
TDD No. 1105-09

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Date: 11/11/11

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Date: 11/11/11

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FIELD SAMPLING PLAN
for a
REMOVAL ASSESSMENT
at the
SMURFIT-STONE MILL
Near Missoula, Missoula County, Montana

CERCLIS ID#: MTN000802850

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1.0 INTRODUCTION

This Field Sampling Plan (FSP) for a Removal Assessment (RA) of the Smurfit-Stone Mill site (CERCLIS ID# MTN000802850) ('the mill') near Missoula, Missoula County, Montana, (Figure 1) has been prepared to satisfy the requirements of Technical Direction Document (TDD) No. 1105-09 issued to URS Operating Services, Inc. (UOS) by the Region 8 office of the U.S. Environmental Protection Agency (EPA) under Superfund Technical Assessment and Response Team 3 (START) contract # EP-W-05-050.

The FSP is a description of a limited, initial field investigation that will be conducted at the mill to determine if a time-critical removal is necessary to protect human health and the environment. The field investigation will also partially fulfill the requirements of a CERCLA Site Inspection (SI) by assessing source areas and exposure pathways with the highest potential for contamination migration, as outlined in the report entitled "Preliminary Assessment, Smurfit-Stone Mill" (the 'PA report') (UOS 2011). This FSP is intended to be used in conjunction with the PA report. A preliminary conceptual site model summarizing potential contaminant transport pathways and routes of exposure is presented in Figure 3.

Site reconnaissance was conducted by UOS personnel on June 22, 2011 in the company of Robert Parker of the EPA. This FSP report is based on observations made during the site reconnaissance, as well as information obtained from historical records; federal, state, and local agencies; and personal interviews.

Mobilization and sampling activities are scheduled to be performed the week of October 24, 2011. A subcontractor will be needed for drilling activities and monitoring well installation to be performed as part of this investigation. An Analytical Results Report (ARR) will present the results of the field investigation and will be completed when all laboratory analytical results are available. The ARR is anticipated to be completed by mid-January 2012.

The fieldwork will include sampling and non-sampling data collection. The field investigation will include the collection of up to 72 field samples (Figure 2). Specific site assessment tasks will include:

- Collection of up to 16 surface soil/source (0-2 feet below ground surface [bgs]) samples from potential source areas, including: sludge ponds, the emergency spill pond, a wastewater storage pond, and a soil landfarming area (includes one background location);
- Collection of up to 10 subsurface soil/source (> 2 feet bgs) samples from sludge ponds, and the emergency spill pond (includes one background location);

- Installation and sampling of up to 10 temporary groundwater monitoring wells, to be completed within the shallow aquifer at the site and to be located within and downgradient of potential source areas, including the sludge ponds, the emergency spill pond, and landfills A and G;
- Sampling of groundwater from up to seven (7) existing monitoring wells and one (1) existing supply well located on the mill property, targeting wells located downgradient of the majority of source areas and adjacent to the Clark Fork River (6 wells), and background locations (2 wells);
- Sampling of groundwater from up to 9 domestic wells located adjacent to and downgradient of source areas;
- Collection of up to 10 co-located surface water and sediment ‘release’ samples, including from locations below 4 facility wastewater outfalls to the Clark Fork River, from O’Keefe Creek, and from background locations (20 total samples from 10 locations);
- Possible collection of a limited number of opportunity samples as dictated by conditions encountered in the field (e.g., surface soil sampling of stained areas within the industrial core area);
- Possible field screening of soils with immunoassay test kits in areas of suspected contamination if visual evidence of contamination is not observed;
- Collection of associated field quality assurance/quality control (QA/QC) samples, to include duplicates and the laboratory matrix spike/matrix spike duplicate (MS/MSD); and
- Determination of the flow rate of O’Keefe Creek during the field event.

Collection of air samples will not be conducted during this field investigation.

Specific sample locations and methods are discussed further in Sections 4.2 and 4.3, respectively. Final sampling locations may change in the field due to unanticipated site conditions.

Samples will be analyzed through the EPA Contract Laboratory Program (CLP) for Routine Analytical Services (RAS) (to include volatile organic compounds [VOCs], semi-volatile organics [SVOCs], Target Analyte List [TAL] Metals, and polychlorinated biphenyls [PCBs] analysis); and Non-Routine Analytical Services (to include dioxins and furans).

A limited number of samples will also be analyzed for asbestos by a private laboratory. Specific laboratory analysis methods and analytical parameters to be used for each sample matrix are discussed further in Section 4.4.

Sampling procedures will adhere strictly to those outlined in the UOS Technical Standard Operating Procedures (TSOPs) for field operations at hazardous waste sites and equipment manufacturers' instructions (UOS 2005b). This FSP is intended to be used in conjunction with the UOS "Generic Quality Assurance Project Plan (QAPP)" (UOS 2005a). The QA/QC samples will follow the requirements of the "Region 8 Supplement to Guidance for Performing Site Inspections under CERCLA" (EPA 1993b).

This FSP has been prepared in accordance with TDD No. 1105-09 and the following EPA guidance documents:

- "Guidance for Performing Site Inspections Under CERCLA," (EPA 1992a);
- "Region 8 Supplement to Guidance for Performing Site Inspections Under CERCLA" (EPA 1993b);
- "Guidance for the Data Quality Objectives Process," (EPA 2000);
- "EPA Requirements for Quality Assurance Project Plans," (EPA 2001); and
- "Guidance for Quality Assurance Project Plans," (EPA 2002).

2.0 OBJECTIVES

The purpose of this removal assessment is to determine if an immediate threat exists to: individuals working on or accessing the property, individuals consuming water from nearby domestic wells, or the environment (particularly surface water receptor targets associated with the Clark Fork River or O'Keefe Creek). Information gathered during this assessment will also be used for the evaluation of this site with regard to the EPA's Hazard Ranking System (HRS) criteria.

It should be noted that this sampling event will not examine every potential source area of the mill property (e.g., underground and above ground storage tank locations) and, therefore, should not be used in isolation to determine any future regulatory or legislative requirements for the site.

The specific objectives of this assessment are to:

- Determine source areas and containment characteristics of source areas at the site, and evaluate these by HRS criteria;
- Determine if contaminants have been transported from site sources, or are likely to be transported from site sources through erosion in the event of catastrophic flooding of the site, to the Clark Fork River or O'Keefe Creek, through direct discharge or through surface or groundwater;

- Determine if contaminants have been transported from the site to nearby domestic groundwater wells, and if so, to determine if contamination is present above appropriate water quality standards and benchmarks;
- Evaluate if an exposure threat from site contaminants exists to on-site workers or other persons accessing the mill property, domestic groundwater users near the site, or to the environment, particularly to surface water receptor targets (e.g., in the Clark Fork River and O’Keefe Creek), and;
- Document the recreational use (particularly for fishing) of the Clark Fork River in the vicinity of the mill.

3.0 SITE DESCRIPTION

3.1 SITE LOCATION AND DESCRIPTION

The Smurfit-Stone Mill was a large integrated pulp and paper mill that was in operation from 1957 through early 2010 (Photos 1, 2, 38 in the PA report). The mill is located 11 miles northwest of the City of Missoula, in Missoula County, Montana and covers approximately 3,200 acres (Figure 1). The mill is located approximately 3 miles south of the town of Frenchtown and, therefore, has often been referred to as the Frenchtown Mill. The facility address is 14377 Pulp Mill Road, Missoula, and the coordinates of the main mill facility are 46° 57' 50.12" north latitude and -114° 11' 58.15" west longitude.

The mill site is located in the northeastern portion of the U.S. Geological Survey (USGS) Primrose Quadrangle Map (USGS 1999). For this assessment, the site boundary is defined by the outside perimeter of the land parcels that constitute the mill property. The legal description of these parcels is provided in Appendix A of the PA report, and the site boundary is shown in Figures 1 and 2 (Montana Department of Revenue [MDR] 2011). The western boundary of the site is the Clark Fork River, with the site having approximately 4 miles of river frontage (Photos 1, 6, 13, 14 in the PA report) (UOS 2011).

Under the HRS, the target distance limit (TDL) of the site is defined as a 4-mile radius surrounding the outside perimeter of the mill property, and the Clark Fork River to a distance 15 miles downstream of the mill site probable point of entry (PPE) (Figure 1). This TDL includes the confluences of creeks draining into the Clark Fork River (Deep, Albert, O’Keefe, Mill, Sixmile, and Ninemile Creeks), as well as the Frenchtown Ponds State Park and portions of the Lolo

National Forest. The site lies within the Montana Audubon Clark Fork River – Grass Valley Important Bird Area (Montana Audubon 2009).

The mill site lies within the Clark Fork River valley and is generally flat, with an elevation range from approximately 3,070 feet near the core industrial area of the mill to approximately 3,040 feet at the Clark Fork River in the northwest corner of the site. Elevations within the 4-mile radius range from approximately 3,015 feet within the Clark Fork River valley to the northwest, to nearly 5,000 feet in the mountains to both the east and west.

The entire site covers nearly 3,150 acres. The core industrial footprint of the mill site covers approximately 100 acres. Over 900 acres of the site consist of a series of unlined ponds used to store both treated and untreated wastewater effluent from the mill, as well as primary sludge recovered from untreated wastewater. Additional unlined ponds were also subsequently used for landfilling various solid wastes produced at the mill. Approximately half of the ponds contain freshwater emergent wetlands. Much of the remaining acreage of the site (approximately 1,800 acres) is used for agricultural purposes, with over 1,200 acres of grasslands for cattle grazing and over 600 acres irrigated for alfalfa and grain crops (MDR 2011, Montana County Rural Initiatives 2010).

3.2 SITE HISTORY

The site began operation as a pulp mill in the fall of 1957. Later expansions and improvements allowed the facility to produce paper, primarily rolls of kraft linerboard that is used in the production of corrugated containers (i.e., the outside layers of cardboard boxes). Linerboard produced at the mill was shipped to box plants where it was used to make a variety of corrugated containers (Smurfit-Stone undated). The mill ceased operations in January 2010.

A timeline of the mill's history, with an emphasis on wastewater discharge information, is provided below (Montana Department of Health and Environmental Sciences [MDHES] 1974, Nielsen 1987, EPA 1999):

- 1956: Waldorf Paper Products Co. of St. Paul, Minnesota announces it will start construction of a \$6 million pulp mill northwest of Missoula, Montana. Groundbreaking occurs in November 1956.

- 1957: Pulp mill begins operation in November with 78 employees and a production capacity of 250 tons per day (tpd) of kraft pulp. No wastewater treatment is initially provided at the mill.
- 1958: First wastewater storage ponds constructed in August following complaints of fish kills, foam, and discoloration in the Clark Fork River. Allowable discharges to river are negotiated with authorities to occur only during high flow periods (March through June). Remainder of discharge is through infiltration through bottom of unlined storage ponds during the storage period of roughly July through February.
- 1960: Mill name becomes Waldorf-Hoemer when Hoemer increases its share to 50 percent. First paper machine and bleaching operation installed in \$6 million expansion. Production increases to 450 tpd of linerboard and 150 tpd of bleached pulp.
- 1962: Montana Board of Health negotiates first discharge conditions with mill for spring discharge season.
- 1966: Mill name becomes Hoemer Waldorf Corporation when Waldorf Paper Products and Hoemer Boxes merge. Second paper machine and two continuous digesters are installed. Capacity increased to 1,150 tpd, of which 150 tpd is bleached pulp.
- 1968: Mill issued first discharge permit by MDHES. Direct discharge allowed to Clark Fork River in spring (high flow) conditions.
- 1969: Primary clarifier installed to remove suspended solids from wastewater prior to storage in settling ponds.
- 1970: Two recovery boilers constructed along with other pollution control measures to reduce emission of odorous gases.
- 1974-1975: Mill installs secondary treatment aeration basins and three experimental 'rapid infiltration' percolation ponds constructed to handle increasing wastewater production. Seven hundred acres of settling ponds are in existence. One-third of 15.7 million gallons per day (mgd) of wastewater effluent is discharged directly to Clark Fork River following primary (clarifier) and secondary treatment. Remainder of wastewater either evaporates or infiltrates through bottom of ponds. An additional 8 mgd of uncontaminated cooling water is discharged to the river after passing

through a ditch to a low lying area to the north of the mill site. First Montana Pollution Discharge Elimination System (MPDES) permit issued in July 1975.

- 1977: Champion International Company purchases mill and begins 3-year \$170 million expansion to increase capacity to 1,850 tpd. Majority of wastewater (63 percent) is being disposed of through rapid infiltration ponds.
- 1978: Second MPDES permit issued.
- 1980: Third paper machine, support systems, and a waste wood boiler for power generation installed.
- 1982: Third MPDES permit issued.
- 1983: Champion applies for permit to allow a portion of effluent to be directly discharged to Clark Fork River throughout the year as rapid infiltration ponds have largely clogged and lost their infiltration capacity.
- 1984: MDHES issues 2-year temporary permit allowing year-round direct discharge to the Clark Fork River (only if flows were greater than 1,900 cubic feet per second [cfs]) and begins study to determine its effects on river. Only 14 percent of wastewater is infiltrating through ponds.
- 1986: Stone Container Corporation purchases mill. MDHES extends permit until an addendum can be completed.
- 1988: Stone Container Corporation completes construction of color removal treatment system to address additional color contributed to wastewater by bleach plant.
- 1990: Old Corrugated Container (OCC) facility added to recycle (repulp) old cardboard containers. First documentation of on-site asbestos disposal.
- 1991: Expanded array of site-wide groundwater monitoring wells installed to comply with MPDES permit.
- 1993: Pulp mill production is approximately 1,900 tons of pulp per day (1,500 tons of virgin kraft pulp from wood chips and 400 tons from repulping old corrugated containers). Closure of three on-site disposal areas and beginning of off-site disposal of asbestos.
- 1994: Montana DEQ issues a Class III landfill license to Stone Container Corporation for land north of Pond 16.

- 1995: New MPDES permit issued addressing nutrients for first time and requiring surface water mixing zone study.
- 1997: Sludge dewatering facility constructed and becomes operational.
- 1998: Name becomes Smurfit-Stone Container Corporation when Jefferson Smurfit Corporation merges with Stone Container Corporation.
- 1998: Combined air and water pollution regulations commonly referred to as the “Pulp and Paper Cluster Rules” are promulgated by EPA that include increased monitoring, containment, and treatment requirements, and also regulate the discharge of chlorinated pollutants from bleaching operations, at kraft pulp mills.
- 1999: Bleaching plant operations cease, Color Removal Plant treatment discontinued.
- 2000: Five-year MPDES permit issued with reduced levels for nitrogen and phosphorus, and requirements for delineating the groundwater mixing zone.
- 2001-2004: Business conditions curtail production to 1,600 tpd of linerboard from 1,100-1,200 tpd of virgin pulp and 550 tpd of recycled pulp from the OCC. Two of three paper machines in operation.
- 2004: Name changed to Smurfit-Stone Container Enterprises Incorporated.
- 2005: Smurfit-Stone Container Enterprises, Inc. applies for a Solid Waste Class III Landfill license for the Peterson Gravel Pits.
- 2009: Smurfit-Stone files for Chapter 11 bankruptcy in January.
- 2010: Smurfit-Stone emerges from bankruptcy, but shuts down mill in January.
- 2011: Mill property purchased by MLR Investments in March. Mill property purchased by M2 Green (Green Investment Group Incorporated) in May.

3.3 PROCESS DESCRIPTION AND WASTE TYPES GENERATED

Sawdust, woodchips and rejected timber (‘pulp logs’) provided the raw wood materials for the mill. Woodchips were brought to the mill by both truck and rail at a rate of up to 3,700 tpd to produce up to 2,200 tpd of linerboard. Other raw materials used in the pulping process included: clay, starch, caustics, ‘hogged fuel’ (bark, sawdust, and rejected wood/chips burned for power generation), and various processing chemicals. From 1990 on, the mill recycled corrugated containers (up to 400 tpd), which provided raw fiber for pulping. Approximately 85 percent of the

kraft linerboard produced at the mill was used domestically, being shipped to other facilities within the corporation (EPA 1993a).

The basic process employed at the mill involved the following five steps:

- Raw material (wood) preparation,
- Separation of wood fibers (pulping),
- Removal of coloring agents (bleaching),
- Paper formation, and
- Power generation/recovery of chemicals.

Raw wood was received as wood chips, sawdust, and logs, which the facility was equipped to debark and chip. The second step, separation of wood fibers or pulping, was accomplished by the use of chemicals (sodium hydroxide and sodium sulfide in a solution called 'white liquor') used at high temperatures with pressures to dissolve impurities and lignins that bind the wood fibers together in process vessels called digesters (large pressure cookers). The mill used both batch and continuous digesters. The resulting spent cooking chemical is called 'black liquor' (EPA 1993a).

Removal of coloring agents (bleaching) was performed only if a light colored or white paper was desired. The mill used a four-step process to produce a specialty grade of white linerboard. Paper formation involved three stages of production: wet end, press section, and dryers. In the wet end, pulp was routed to the paper mill where various chemical additives such as rosin, alum (an aluminum sulfate complex used to precipitate the rosin onto the paper), dyes, and clay (a filler) were added. Fiber slurry was screened, and a paper sheet was formed by distributing a web of fiber onto a continuously moving screen. The sheet was pressure rolled and then dried on heated cylinders. These processes served to reduce the moisture content of the paper product from over 99 percent to less than 6 percent.

The final step in the process was the reclamation of spent cooking liquor, which was concentrated using evaporators and burned in recovery boilers that burned organic wastes. Inorganic material (sodium and sulfur) in the concentrated black liquor was collected as a molten 'smelt' in the bottom of each recovery furnace and overflowed into a smelt dissolving tank, forming 'green liquor.' The green liquor was processed back into white cooking liquor through a recausticizing process using sodium hydroxide, lime kilns, lime mud filtering, washers, and clarifiers. The

boilers supplied enough excess heat to generate steam power that was used to help run the mill (EPA 1993a).

From 1990, recycled pulp was also produced from OCC by thermo-mechanical pulping processes that did not use the cooking liquors described above. Specialized equipment was used to remove impurities (i.e., waxes, glues, plastics, Styrofoam, plastic, staples). This recycled pulp contributed approximately 550 tpd to total pulp production.

Various hazardous chemicals were used or produced on site, including bleaching chemicals (liquid chlorine, sodium hypochlorite, and chlorine dioxide), liquid sulfur dioxide, liquid ammonia, sodium hydroxide, sodium salts, dimethyl disulfide, methylsulfide, liquors of high pH (white, green, and black) used in pulping, turpentine, acids (sulfuric, muriatic, and phosphoric), and non-condensable gases. Various quantities of bulk petroleum products, including diesel fuel and #6 fuel oil, were stored on site. PCBs were used in electrical transformers at the site, but it has been reported that these transformers have been removed (Marxer 2011). No spills appear to have been reported during removal activities. PCBs may also have been present as an additive in hydraulic fluids in equipment, such as those found in the rail car dump area, the hog fuel unloading area, the baler room of the OCC, and the bleach plant.

The use of chlorine for the bleaching of pulp produces chlorinated organic compounds, including dioxins, furans, phenols, guaiacols, catechols, chloroform, and numerous others through the reaction of chlorine with residual lignin (EPA 1990). Organic halides are also of concern at kraft pulp mills where bleaching has been performed (EPA 1993a).

Potential sources of metals at pulp and paper mills include chemical additives to the pulping process, biocides that contain mercury, and dyes such as cadmium salts. Fly ash from boilers may concentrate naturally occurring metals found in soils.

From 1986 through March 2010, the mill was registered under the Resource Conservation and Recovery Act (RCRA) as a Small Quantity Generator of hazardous waste (specifically in 2009 for ignitable waste, mercury, methyl ethyl ketone, and methylene chloride) (MDEQ 2011a).

Waste types generated at the mill included solid, liquid, and gaseous emissions. Solid wastes were landfilled on site in at least four separate areas until October 1993, when the landfills were closed to comply with solid waste disposal laws (Smurfit-Stone 2004). Also in 1993, Smurfit-Stone licensed and began using a Class III (inert material) disposal site located in the

northwestern area of the mill site (Landfill G on Figure 2). In November 2005, Smurfit-Stone applied for a license for an additional Class III landfill to convert the Peterson Gravel Pits on the site to a landfill. This license appears to have been denied. After 1993, Class II wastes (e.g., general refuse, fly ash, asbestos) generated by the facility were disposed of offsite at BFI's Missoula landfill.

Waste types generated by the mill are shown in the following table (MDHES 1974, 1985; EPA 1993a; Smurfit-Stone 2004; MDEQ 2010a):

TABLE 1
Waste Types Generated at the Smurfit-Stone Mill Site

Waste	Possible Contaminants	Approximate Volume Generated (Annually)	Disposal Location
SOLIDS			
Primary sludge ¹	Dioxins, furans, PCBs, organic halides, chlorinated phenols, petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), arsenic, cadmium and other metals	20,000 tons	On site (ponds 3, 4, 5, 17, and likely ponds 19 [aka Area D] and 20 [aka Area E])
General municipal waste ²	Industrial chemicals (e.g., solvents), hydrocarbons, degradation products	148,000 cubic yards (yd ³)	On site (Landfill A) until 1993, then off site to BFI
Hog Fuel ash and fly ash ³	Probably non-hazardous, unless non-wood fuel was burnt in boiler	20,000 yd ³	Hog fuel ash: on site (pond 6, Area C) until 1993, then off site to BFI Fly ash: on site (ponds 3, 4, 5, 17)
Lime kiln/ slaker grits ⁴	Probably non-hazardous, but is caustic if not washed	17,000 yd ³	On site (pond 6, Area C) until 1993, then sludge ponds
Ragger wire ⁵	Probably non-hazardous	7,000 yd ³	On site (Area C) until 1993, then off site to BFI
Asbestos insulation ⁶	asbestos	On site (total generated 1990-1993): 2,870 linear feet (lf) of pipe insulation, 1,078 square feet (ft ²) of boiler insulation Off site (total generated 1990- 2008): 17,758 lf of pipe insulation and 13,997 ft ² of other materials	On site (Areas C, F; Landfills A, G; Pond 6) and off site until 1993, then all off site to BFI

TABLE 1
Waste Types Generated at the Smurfit-Stone Mill Site

Waste	Possible Contaminants	Approximate Volume Generated (Annually)	Disposal Location
Woodyard waste ⁷	Probably non-hazardous	12,000 yd ³	On site (Landfill G)
LIQUIDS			
Wastewater ⁸	Dioxins, furans, PCBs, organic halides, chlorinated phenols, petroleum hydrocarbons, PAHs, arsenic, cadmium and other metals, nutrients	Up to 6.02 billion gallons (e.g., 1984). Avg. 5.7 billion gallons (e.g., 2009).	Combination of: <ul style="list-style-type: none"> • direct discharge to Clark Fork River (1958-1984 during high flows only, 1984-2010 year round if flows >1,900 cfs), • ‘rapid infiltration’ through ponds to groundwater (1974-1983), • pond seepage to groundwater (1958-2010), and • evaporation (1958-2010)
Black, green, white liquors; bleaching waste streams ⁹	high pH liquids, chlorine, salts, acids (sulfuric, muriatic, and phosphoric)	Approx. 1 billion gallons	Largely recovered and recycled, but some losses to sewer due to overflows, spills, and wash-ups. Sewer reported to wastewater treatment system.
Cooling water (non-contact)	Non-hazardous unless spills or leaks occurred	Avg. 2.37 billion gallons	Direct discharge to Clark Fork River (1958-2010)
GASES			
Total reduced sulfur compounds; oxides of sulfur (SOx); oxides of nitrogen (NOx)	<ul style="list-style-type: none"> • hydrogen sulfide (H₂S), • methyl mercaptan, • dimethyl sulfide, • dimethyl disulfide, SO_x, NO_x 	Varies per source, up to limits imposed by Montana Air Quality Permit issued for site (#2589-15)	Discharge to air controlled variously by electrostatic precipitators, wet scrubbers and wet venture scrubbers, baghouses, air and steam strippers
Particulates	<ul style="list-style-type: none"> • sodium sulfate, • sodium carbonate, • other sodium compounds 	Varies per source, up to limits imposed by Montana Air Quality Permit issued for site (#2589-15)	Discharge to air controlled variously by electrostatic precipitators, wet scrubbers and wet venture scrubbers, baghouses, air and steam strippers

1 Primary sludge was the underflow from the primary clarifier, and was reported to have been primarily composed of water, hog fuel ash, lime, calcium carbonate mud, green liquor dregs (unburned carbon from recovery boilers) and 1 percent wood pulp fiber. However, the clarifier also received effluent from all site drainage (i.e., sewers) and process streams, including the pulping mill and the paper mill areas, and the ‘clearwater’ sewer originating at the white water and stock tank overflow (excess water derived from the drying of paper). All on-site spills would have reported to these sewers.

2 General municipal waste consisted of miscellaneous waste such as paper, plastic, wood, scrap metal, glass, and small amounts of food.

- 3 Hog fuel ash originated from multicyclone collectors on two bark boilers and from the bottom grates in the boilers.
- 4 Lime kiln/slaker grits are unreacted lime kiln product that was rejected from the slaker where rebumed lime (CaO) was added to green liquor (NaOH + Na₂S).
- 5 Ragger wire was plastic and metal wire that held bales of old cardboard containers together.
- 6 Asbestos originated from disturbed insulation and through maintenance and replacement of equipment.
- 7 Woodyard waste was generally wood chips that got mixed with soil and rocks at the bottom of a stockpile.
- 8 Approximately 200 organic compounds have been identified in pulp, paper, and paperboard wastewaters. The principal waste parameters of concern with these waters are wood waste residuals that produce biological oxygen demand (BOD), pH, total suspended solids, and effluent color from bleaching operations.
- 9 Black liquor was spent cooking liquor remaining after the digesting process. It contained spent cooking chemicals, lignins, and other extractions from the pulp with a solids content of ~18 percent. After further evaporation, lignins and organic wastes were burned in power recovery boilers. Molten inorganics (e.g., sodium and sulfur) were recovered in the bottom of the recovery furnace, forming green liquor. Green liquor was processed back into white liquor in the recausticizing process, which used lime kilns, slakers, lime mud filters, washers and clarifiers. Its chemical constituents were largely sodium hydroxide and sodium sulfide.

The pulp and paper industry uses a large volume of water as a fiber carrier and solvent. Little of the process water was recycled at the Smurfit-Stone facility; therefore, it generated up to 6.02 billion gallons of wastewater per year.

During its initial operation, all wastewater was apparently released directly to the Clark Fork River without treatment (Nielsen 1987). Beginning in 1958, wastewater was stored on site in unlined ponds from July through February before being discharged to the river under high flow, spring runoff conditions (March through June). During the storage months, a substantial amount of water seeped through the bottom of the storage ponds. Over the years, as the mill expanded and as the seepage rates from the ponds decreased due to accumulation of biological and residual organic solids in the bottom sediments of the ponds, additional storage ponds were constructed. By 1971, fifteen ponds had been constructed covering approximately 750 acres (MDHES 1974).

A primary clarifier was constructed in 1969 to remove solid constituents (primary sludge) from the wastewater, which was pumped into four sludge ponds. Beginning in 1974, the mill experimented with 'rapid-infiltration' gravel basins as a means to facilitate seepage rates into groundwater. This process largely ended by 1983 due to clogging of the basins by organic matter.

Secondary treatment, in the form of a two-stage aeration basin, also began at the mill in 1974. A third basin was added in 1990. From the aeration basins, wastewater flowed to polishing ponds, and then on to a series of treated water storage ponds before discharge to one of three outfalls. Year-round discharge of treated wastewater to the Clark Fork River began in 1984, being permitted only when river flows exceeded 1,900 cubic feet per second (Smurfit-Stone 2004).

Wastewater flow diagrams are presented in Appendix E of the PA report (Smurfit-Stone 2004).

3.4 PREVIOUS INVESTIGATIONS

Previous environmental investigations at the site appear to have been undertaken by both the mill and by the MDHES, largely to document surface and groundwater quality in an effort to understand and address nutrient loading to the Clark Fork River. For example, beginning in 1983 the MDHES conducted a 2-year study to determine the effects of year-round direct discharge of wastewater from the mill to the Clark Fork River (MDHES 1985). The study documented nutrient, suspended solids, dissolved oxygen, ammonia and metals, and color concentrations in the river; investigated its ecological health (e.g., macro-invertebrate sampling); and identified aesthetics (especially the appearance of foam and colored water), groundwater pollution of the shallow aquifer, and ongoing air quality degradation (especially odor and particulates) as areas of concern.

The 1995 MPDES discharge permit required the mill to conduct a surface water mixing zone study to delineate the boundary condition of the mixing zone for the direct discharge of wastewater to the Clark Fork River (Hydrometrics 1996). The finding of this study determined that the downstream monitoring station for the mill (i.e., the Huson sampling station located 6 miles downstream from the site) was a valid location for compliance monitoring and a reasonable location for determination of the mixing zone boundary.

The MPDES permit issued in 2000 required that the mill delineate the “groundwater mixing zone boundary condition,” defined as the extent of travel of seepage where the groundwater concentration for total dissolved solids (TDS) was greater than or equal to 500 milligrams per liter (mg/L). The permit also required Smurfit-Stone to monitor groundwater wells (Photo 11 in the PA report) for the purpose of establishing correlation factors for concentrations of nutrients between newer and older monitoring wells. This investigative work was completed in November 2004 and found that groundwater with TDS concentrations > 500 mg/L was largely contained between Marcure Lane on the north, Mullan Road on the east and the Clark Fork River to the west; and that water quality sampling within seven residential wells near the downgradient boundary of the groundwater mixing zone showed high quality drinking water with no influence of process wastewater constituents or TDS from the shallow alluvial groundwater system (Hydrometrics and Inskeep 2004).

Environmental compliance monitoring performed at the site included the following (EPA 1993a, MDEQ 2010b, Smurfit-Stone 2004):

- Wastewater discharge: nutrients (nitrogen and phosphorus), pH, Biological Oxygen Demand (BOD), total organic carbon (TOC), total suspended solids (TSS), ammonia, color and toxicity, with occasional testing for dioxins;
- Non-contact cooling water discharge: oil sheen, foam, temperature, and weekly pH;
- Groundwater: nutrients, color, sodium, and BOD every 2 months to determine seepage contribution the Clark Fork River;
- In-stream monitoring of the Clark Fork River: color, temperature, dissolved oxygen, and nutrients; and
- Air: total reduced sulfur, opacity, NO_x, sulfur dioxide, total suspended particulates, and particulate matter smaller than 10 microns in diameter (PM₁₀).

Site assessments have apparently been performed at six of eight petroleum storage tank locations at the site. The assessments found evidence of leaks at three of the tanks. The remediation of the releases is being overseen by the Petroleum Release Section of the MDEQ.

Previous investigations by the EPA appear to be limited to a chemical safety audit conducted by the Region 8 Technical Assistance Team from February 9 through 12, 1993. The purpose of the audit was to document facility processes, chemical hazards, accidental release prevention practices, and emergency response preparedness and planning (EPA 1993a).

3.5 SITE GEOGRAPHY, GEOLOGY, HYDROGEOLOGY AND METEOROLOGY

3.5.1 Geography

The Smurfit-Stone Mill site is located within Missoula Valley of the Clark Fork Basin. The basin is bounded by the Continental Divide on the east and south, the Montana-Idaho state line on the west, and the Flathead River-Clark Fork divide to the north. The Valley has an area of about 180 square miles and is drained by the Clark Fork River, Ninemile Creek, and their tributaries (USGS 1999).

3.5.2 Geology and Hydrogeology

The Missoula Valley was flooded and drained during successive glaciations and interglaciations in the Pleistocene Epoch (1 million years ago to 25,000 years ago). About 12,000 years ago, the Missoula Valley lay beneath a lake nearly 2,000 feet deep. Glacial Lake Missoula formed as the Cordilleran Ice Sheet dammed the Clark Fork River just as

it entered present day Idaho. Fill from the lake is estimated to reach a maximum depth of 3,000 feet within the valley (Montana Bureau of Mining and Geology [MBMG] 1965).

The mill site is underlain by alluvial sands and gravels, bounded on the west side of the Clark Fork River by Precambrian bedrock and by fine-grained Lake Missoula deposits immediately east. The shallow alluvial sands and gravels are approximately 25 to 35 feet thick beneath the mill site and thin to the east. Depth to groundwater across the site in July/August of 1991 varied from 2.4 to 19.8 feet (Grimestad 1992). Fine-grained Lake Missoula sediments (clays and silts) extend beneath the shallow alluvial gravels and are approximately 120 to 150 feet thick. The Lake Missoula sediments are underlain by a thick coarse-grained alluvial aquifer. This deeper aquifer system is the principal aquifer for water supply in the area, including Smurfit-Stones production wells (MBMG 1998, Hydrometrics and Inskeep 2004).

The fine-grained Lake Missoula sediments have a reported vertical permeability of 3.5×10^{-5} centimeters per second (cm/s). The estimated hydraulic conductivity of the deep alluvial aquifer is 5.3×10^{-1} cm/s (Grimestad 1992).

3.5.3 Meteorology

The mill site is located in a semiarid climate zone. Prevailing wind direction is from the northwest. The mean annual precipitation as totaled at the Missoula International Airport is 13.81 inches (National Oceanic and Atmospheric Administration [NOAA] 2011a). The 2-year, 24-hour rainfall event for this area is 1.37 inches (NOAA 2011b).

4.0 PRELIMINARY PATHWAY ANALYSIS

4.1 SOURCE CHARACTERIZATION

A detailed summary of potential sources of contamination at the site is provided in the PA report (UOS 2011). For the purpose of this FSP, a brief description of the source areas and exposure pathways with the highest potential for contamination is provided below:

4.1.1 Sludge Ponds

From the mills inception until the late 1960's, wastewater did not undergo treatment beyond what occurred naturally when the water was stored in ponds (e.g. settling).

Following the installation of the primary clarifier at the mill in 1969, approximately 20,000 tons of sludge was generated on a yearly basis and pumped to four sludge ponds (Ponds 3, 4, 5, 17) (Figure 2). These four ponds cover 91 surface acres, vary in depth from approximately 7 feet (Pond 17) to 14 feet (Pond 5), and together amount to approximately 899 acre-feet in total capacity.

Bleaching operations occurred at the mill from 1960 through 1999. Previous studies at other similar pulp and paper mills have shown that when chlorine is used as a bleaching agent for brightening and purifying wood pulp, polychlorinated dibenzodioxins (PCDDs) including 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), and polychlorinated dibenzofurans (PCDFs), including 2,3,7,8-tetrachlorodibenzofuran (2,3,7,8-TCDF), can be formed (EPA 1987). Although these compounds may be present in treated effluent, wastewater sludges, and in the bleached pulps themselves, the highest concentrations were found in sludges.

The clarifier also received effluent from all site drainages (i.e., sewers) and process streams, including the pulping mill and the paper mill areas, and the 'clearwater' sewer originating at the white water and stock tank overflow (excess water derived from the drying of paper) (EPA 1993a). Potential contaminants associated with these waste streams include acids, high pH liquids, chlorine, salts, chlorinated phenols, petroleum hydrocarbons, and PCBs associated with hydraulic oil releases.

Ponds built at the site were not lined, and percolation of wastewater through the bottom of the ponds into the shallow alluvial aquifer was relied on as a means of water disposal (MDHES 1974, Smurfit-Stone 2004).

Primary (from the clarifier) and secondary (dredged from basins and ponds) sludge was reportedly also disposed into two smaller areas (Areas D [Pond 19] and E [Pond 20]) (Figure 2) to the north of the four larger sludge ponds (Stone Container 1992). For the purposes of this assessment, these ponds are considered to have lesser potential for high levels of contamination and will not be sampled. Nevertheless, groundwater directly downgradient of these potential sources will be investigated.

4.1.2 Emergency Spill Pond

The three sewer/process streams from the industrial core area were continuously monitored for flow rate and conductivity to allow for the identification of spills and process upsets. When these occurred, flows could be diverted to an emergency spill pond (Pond 8) before they reached the primary clarifier (EPA 1993a, Smurfit-Stone 2004) (Figure 2). The dates, quantities, and constituents of spills that may have occurred are unknown.

The pond is divided into two cells, one being a 'dry' cell reportedly held in reserve unless needed (Marxer 2011). The 'dry' cell has also been reported as previously being a sludge pond, but was isolated in the early 1990s in anticipation of its being used as the next general refuse waste disposal location (MDHES 1992, Stone Container 1992). The cells have a combined surface acreage of 24 acres, an average depth of 5 feet, and a capacity of approximately 120 acre-feet. The date Pond 8 was constructed is not clear. There is no evidence in available documents that the pond was lined.

4.1.3 Aeration Basins, Polishing Ponds, and Wastewater Ponds

Beginning in 1974, after sludge was removed from the clarifier, wastewater was transferred to a series of three aeration basins that were operated in series (Smurfit-Stone 2004) (Figure 2). The three basins have a combined surface area of 56 acres, an average depth of 12 feet, and a total capacity of approximately 670 acre-feet.

Two polishing ponds were used for further settling of biological solids after aeration of the wastewater. The two polishing ponds have a combined surface area of 43 acres, an average depth of 7.6 feet, and a total capacity of 328 acre-feet.

After polishing, treated wastewater was diverted to 12 storage ponds prior to discharge from three permitted outfalls to the Clark Fork River (Ponds 1, 1A, 2, 7, 9, 10, 11, 12, 13, 13A, 16, and 18). The 12 ponds have a combined surface area of 707 acres, an average depth of approximately 8 feet, and a total capacity of 5,772 acre-feet.

Ponds built at the site were not lined, and percolation of wastewater through the bottom of the ponds into the shallow alluvial aquifer was relied on as a means of water disposal (MDHES 1974, Smurfit-Stone 2004).

It is assumed that possible contaminants in the basins and polishing and storage ponds are similar to those in the sludge ponds, but would be expected to be at lower concentrations, if present. For the purposes of this assessment, these ponds are considered to have lesser potential for high levels of contamination and only one pond (Pond 2) will be sampled directly.

4.1.4 Landfills and Other Dumping Locations

The mill landfilled all facility-generated solid waste on site from the inception of the mill (1957) until 1993. The majority of landfilling occurred in an area immediately adjacent to and west of the core industrial area of the mill (Figure 2). Disposal primarily occurred in three areas (Stone Container 1992):

- Landfill A: General refuse (including, but not limited to paper, plastic, scrap metal, wood, glass, and small amounts of food);
- Pond 6: hog fuel ash, lime kiln grits, and;
- The adjacent areas C (hog fuel ash, lime kiln grits, ragger wire) and F (asbestos).

For simplicity, these areas will be referred to henceforth in this report as landfills (see Figure 2).

These areas were capped with 18 inches of clay and 6 inches of topsoil and formally closed in September 1995 (MDEQ 1995). There is no evidence in available documents that any landfilling area was lined. Given the history of similar landfills located on other industrial facilities across the nation, it is possible that hazardous wastes were disposed of on site prior to 1993.

Beginning in October 1993, all Class II waste generated by the mill (e.g., general refuse, ragger wire, multi-fuel boiler ash, used oil filters) was hauled off site for disposal. Class III material (e.g., sawdust, wood chips mixed with soil and gravel, log yard wood wastes, kiln bricks, small quantities of tires and other inert material) was then landfilled in a newly permitted area (Landfill G on Figure 2) adjacent to and north of Pond 16 (Stone Container 1995, Smurfit-Stone 1995). Double-bagged asbestos has also been disposed of in this location (Stone Container 1992).

The main facility general refuse landfill (Landfill A) has a surface area of 16 acres and an average depth of about 6 feet. Landfill (Pond) 6 has a surface area of 16 acres with an unknown average depth. Landfills C and F have surface areas of approximately 8 acres and 3 acres, respectively. The Class III landfill begun in 1993 (Landfill G) has a surface area of approximately 6 acres (Figure 2).

Groundwater downgradient or directly beneath these potential sources will be investigated as part of this RA.

4.1.5 Industrial Area (Recausticizing Area; Liquor Alley; Bleach Plant; Truck, Railcar, and Hog Fuel Unloading Areas; Sewer Lines and Sumps)

The main industrial area of the mill covers approximately 100 acres. Although the kraft pulping process used at the mill depended heavily on the recovery and reuse of chemicals (particularly from the high pH liquors), the plant was designed such that 'sewer' lines from various areas of the facility would capture any leaks, spills, and overflows from transfer, handling, and storage systems, and direct them to the primary clarifier (MDHES 1974, EPA 1993a, Smurfit-Stone 2004).

The acid tanks were equipped with secondary containment, as were the # 6 fuel oil tank and all transformers (EPA 1993a). Other equipment maintenance procedures reported to have been in place included the regular inspection and replacement of process lines (e.g., batch digester, chlorine, sulfur dioxide, acid transfer hoses). Spills of petroleum or chemicals of sufficient volume were directed to the mill's sewer system. Spills that reached the sewer system could be manually routed to the emergency spill pond (Pond 8) before reaching the primary clarifier (EPA 1993a).

The site reconnaissance conducted on June 22, 2011 did not include an inspection of the core industrial facility. In addition, detailed site plans of the facility were not available. As such, the identification of discrete point sources of potential contamination within the facility (e.g., sewer sumps, sewer line leaks) was not possible.

4.1.6 Landfarming Area

Landfarming of hydrocarbon-contaminated materials is reported to have occurred on a parcel of mill property located south of and adjacent to Lacasse Lane (Figure 2). While

no documentation of this activity was found, the practice was acknowledged by Neal Marxer, former Technical Services Manager, at the mill during the site reconnaissance (Marxer 2011). It is possible that landfarmed material included hydraulic fluid containing PCBs.

4.1.7 Above Ground and Underground Storage Tanks

There are records of eight storage tanks (four above ground tanks [ASTs] and four underground tanks [USTS]) at the mill (MDEQ 2011b). As assessment and remediation activities in relation to these tanks are being overseen by the MDEQ, they will not be considered as part of this RA.

4.2 GROUNDWATER PATHWAY

The Smurfit-Stone Mill site is located adjacent to the Clark Fork River. The mill is underlain by a shallow alluvial sand and gravel aquifer. The alluvial aquifer is approximately 25 to 35 feet thick beneath the mill site and thins to the east. This alluvium is bounded on the west side of the Clark Fork River by Precambrian bedrock and by fine-grained Lake Missoula deposits immediately east of the mill site (Hydrometrics 2004).

The fine-grained Lake Missoula sediments extend underneath the shallow alluvial gravels, are approximately 120 to 150 feet thick, and have a reported vertical permeability of 3.5×10^{-5} cm/s (Grimestad 1992). These sediments are underlain by a thick coarse-grained alluvial aquifer, which is the principal water supply aquifer for both the mill and for local ranches (Hydrometrics and Inskeep 2004). The estimated hydraulic conductivity of this deep alluvial aquifer is 5.3×10^{-1} cm/s (Grimestad 1992).

Depth to groundwater within the shallow alluvial (unconfined) aquifer varied across the site from 2.4 to 19.8 feet in July/August of 1991 (Grimestad 1992).

Groundwater flow directions in the shallow alluvial aquifer are generally to the west and north in the vicinity of the mill, towards the river. However, flow directions vary seasonally in response to areal recharge, water level fluctuations in the mill's wastewater storage ponds, seasonal changes in the stage of the Clark Fork River, and seasonal flows in irrigation ditches (Hydrometrics and Inskeep 2004). Groundwater velocity measured in background wells on the mill site average 4

feet per day, and hydraulic conductivity measured across the entire mill site averages approximately 335 feet per day (Grimestad 1992).

Ponds built at the site were not lined, and percolation of wastewater through the bottom of the ponds into the shallow alluvial aquifer was relied on as a means of water disposal (MDHES 1974, Smurfit-Stone 2004). As such, the shallow alluvial aquifer has been contaminated with mill effluent. As reported by the MDHES in the Environmental Impact Statement for the proposed expansion of the mill:

The shallow aquifer underlying the effluent storage ponds contains considerable seepage water from the pond system. Pond wastes have also entered the deep aquifer in the vicinity of the plant. The quality of percolated wastewaters is significantly inferior to natural groundwater. (MDHES 1974, page 180).

In addition, Grimestad has stated:

...ongoing Mill chemical sampling indicates that the underlying groundwaters are already carrying a significant load of the expected leachate constituent chemicals from nearby storage pond and effluent-distribution ditch leakage. (Grimestad 1992, page 11).

Although both Grimestad, and Hydrometrics and Inskeep reported that groundwater flow occurs from the deeper aquifer upwards to the shallow aquifer, MDHES reported in 1974 that, although there was a poor vertical hydraulic connection between the aquifers, pond wastes had already entered the deep aquifer due to leakage from the upper to the lower aquifer (MDHES 1974).

Whether releases to groundwater have occurred from other contamination sources (e.g., petroleum storage tanks, the industrial core area) is unknown. Groundwater analysis appears to have been limited to analytes related to general water quality (e.g., TDS, sodium) and nutrients, as per permit conditions (Smurfit-Stone 2004).

Numerous drinking water wells exist within 4 miles of the site (Table 2), including seven private domestic wells located along the northern boundary of the site and within the groundwater mixing zone boundary for the site effluent (Hydrometrics and Inskeep 2004). All of the wells are completed in the deeper aquifer (total depths range from 141.5 to 169 feet bgs).

Water quality samples collected from five of these seven residential wells showed no measured parameters above background levels and no evidence of influence from mill process water or constituents (Hydrometrics and Inskeep 2004).

All municipal water supply systems in the local area utilize groundwater (EPA 2011b). The nearest municipal wells to the mill are two adjacent public supply wells for the Magnolia Estates located at 13475 Mullan Road, approximately 700 feet from the mill property boundary (and 1 mile upgradient from sludge pond 17) (MBMG 2011). According to the EPA Safe Drinking Water Information System, there are no records of any health-based violations reported by the State of Montana for this water supply. The next closest public supply wells are associated with the Frenchtown Valley View Trailer Court, located approximately 0.5 mile north of the northern boundary of the mill. While the State of Montana has reported multiple violations of coliforms above the maximum contaminant level (MCL) for this water system, violations for potential contaminants from the mill have not been reported (EPA 2011a). Municipal supply wells located more distant from the site were not searched for health-based violations.

There are an estimated 4,364 people within 4 miles of the site who use groundwater domestically. A summary of commercial and private wells located within a 4-mile radius of the mill site is provided in Table 2 below:

TABLE 2
Wells within 4 Miles of the Smurfit-Stone Mill Site

Radius (in miles)	Number of Wells	Estimated Population Served*
0 – 0.25	57	140
0.25 – 0.50	63	155
0.50 – 1.0	156	384
1.0 – 2.0	362	891
2.0 – 3.0	677	1665
3.0 – 4.0	459	1129
Total	1,774	4,364

* Assumes one well per household and 2.46 persons per household for Missoula County.

Sources: State of Montana, Department of Natural Resources and Conservation, Water Resources Division, 2011; US Census Bureau 2010 census (U.S. Census Bureau 2011).

The mill also used groundwater for the facility water supply. The Montana Ground-Water Information Center lists over 40 for wells registered by various previous owners of the mill property for industrial, fire protection, monitoring and domestic use (MBMG 2011). The present

status of these wells, and the intentions the owners have for their future use or abandonment, is not clear.

4.3 SURFACE WATER PATHWAY

The western boundary of the site is the Clark Fork River, with the site having approximately 4 miles of river frontage (Figure 2, Photos 1, 6, 13, 14 in the PA Report). Chloride-ion concentrations in mill site groundwater monitoring wells show that mill effluent percolating through the wastewater storage ponds reaches the river (Grimestad 1992).

According to the 2008 Waterbody Report for the Clark Fork River, this stretch of the Clark Fork River (Fish Creek to Rattlesnake Creek) is impaired due to elevated levels of: arsenic, cadmium, copper, chlorophyll-A (algal growth), total nitrogen, total phosphorus, and organic enrichment (sewage). Some of the metals are due to mill tailings that were historically deposited into the Clark Fork River drainage upstream (i.e., from Butte, Montana downstream to Milltown, just upstream from Missoula). The nutrients and organics are largely attributed to municipal and industrial point sources of pollution such as the mill and the Missoula wastewater treatment plant (EPA 2011c).

The MDEQ has conducted water quality sampling from a number of locations along the Clark Fork River adjacent to and near the mill site. The vast majority of data are related to general water quality monitoring (pH, temperature, cations and anions) and nutrient loading to the river, although metals have also been analyzed at some locations (Station ID: 4214CL06).

As part of its National Bioaccumulation Study, the EPA collected fish tissue from both a largescale sucker and a rainbow trout at a location on the Clark Fork River near the Huson sampling station (approximately 6 miles downstream of the mill site). The tissue from the sucker showed levels of various PCB congeners exceeding environmental or human health guidelines, as well as detectable amounts 2,3,7,8-TCDF. The rainbow trout was only analyzed for dioxins and furans but also showed a detectable amount of 2,3,7,8-TCDF (EPA 1992b).

Effluent sampling results from a water sample collected from a wastewater storage pond as reported in the 2010 MPDES permit application state that 2,3,7,8-TCDD was not detected at a reporting limit of 3.9 picograms per liter (pg/l) (MDEQ 2010a).

Surface water targets include sensitive environments downstream of the site. All municipal water supply systems in the local area appear to utilize only groundwater (EPA 2011b). It should be noted that shallow groundwater wells along the Clark Fork River downstream of the site would most likely be influenced by flows from the river (e.g., during spring runoff periods when the river would be a 'losing' stream).

The Clark Fork flows from the south to the north and has an annual mean discharge at a point below Missoula (USGS station 12353000, 4.5 miles west of Missoula) of 5,293 cubic feet per second (USGS 2011). Construction of the wastewater storage ponds on the mill site led to the relocation of the Clark Fork River channel to the west. Much of the mill site lies within the Federal Emergency Management Agency 100-year floodplain (FEMA 1988).

The mill site lies within the Clark Fork River valley and is generally flat, with an elevation range from approximately 3,070 feet near the mill facility to approximately 3,040 feet at the Clark Fork River in the northwest corner of the site. Overland flow from the site would generally travel west towards the river, although much of it would be captured in ponds or diverted by various ditches and channels, such as the non-contact cooling water ditch (Photo 10 in the PA Report).

O'Keefe Creek flows from east to west across the southern extent of the mill property, adjacent to Ponds 17 (sludge), 1 A and 2 (both treated wastewater storage) (Figure 2). The USGS reported a stream flow measurement of 186.0 cubic feet per second from O'Keefe Creek in 1980 (USGS 2011). The creek had a substantial flow during the site reconnaissance in June 2011 (Photo 16 in the PA Report).

Approximately half of the ponds contain palustrine freshwater emergent wetlands. The National Wetlands Inventory Database identifies over 2,600 acres of riverine and palustrine wetland within 4 miles of the site, and riverine wetlands are continuous downstream of the mill for the entire extent of the 15-mile downstream TDL (see Appendix F of the PA Report) (USFWS 2011a). However, only about 25 percent of these are HRS-eligible (i.e., meet the definition of a wetland under 40 CFR 230.3, rather than the USFWS definition).

Within the TDL, there are approximately 135 acres of HRS-eligible palustrine freshwater forested/shrub wetlands and 8 acres of freshwater emergent wetland directly adjacent to the Clark Fork River, equating to over 8 miles of wetlands frontage.

The entire length of the 15-mile TDL is considered a fishery with a Montana Fish, Wildlife and Parks (MFWP) fishery resource value of 1 (Outstanding). The MFWP Deep Creek fishing access site is located at the confluence of Deep Creek and the Clark Fork, approximately 0.5 mile upstream of the southern mill site boundary. The 423-acre MFWP Erskine fishing access site begins approximately 2.5 miles downstream of the mill site and stretches for approximately 2.5 river miles. There were an estimated 37,996 angling days per year on this segment of the Clark Fork River in 2009. Recreational fishing for the following species is reported in the fishery: brown trout, largemouth bass, mountain white fish, smallmouth bass, rainbow trout, northern pike, yellow perch, and westslope cutthroat trout (MFWP 2011). It is assumed that fish are caught for consumption, but evidence of this has not been gathered.

An estimate of the quantity of fish in the segment of the river adjacent to the mill could not be found. However, a 1990 fish survey along the Erskine fishing access site showed 17 brown trout for every 1,000 feet of river length (MFWP 2011). A 2007 study within the Deep Creek fishing access site found no mussels were present (MFWP 2010).

Numerous river rafting companies offer float trips on the Clark Fork River, although it is not clear if any float the segment of the river adjacent to the mill site.

The river segment adjacent to the mill is listed as a Wildlife Protected Area as it is a bald eagle nesting area, a big game critical wintering area, and is a historic peregrine falcon nesting area (MFWP 2011).

Threatened and endangered species present within Missoula County are shown in Table 3 below (USFWS 2011b):

TABLE 3
Endangered and Threatened Species in Missoula County

Species Scientific Name	Common Name	Status
<i>Haliaeetus leucocephalus</i>	Bald Eagle	*
<i>Ursus arctos horribilis</i>	Grizzly Bear	Federally-listed Threatened
<i>Howellia aquatilis</i>	Water Howellia	Federally-listed Threatened
<i>Lynx canadensis</i>	Canadian Lynx	Federally-listed Threatened
<i>Salvelinus confluentus</i>	Bull trout	Federally-listed Threatened

*Though not currently listed as threatened or endangered by the USFWS under the Endangered Species Act, the bald eagle is still protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

The Clark Fork River has been identified as nodal habitat for the federally listed endangered bull trout. Nodal habitats are defined as waters that provide migratory corridors and over-wintering areas, or are otherwise critical to the population at some point in its life history. Nodal waters are essential for the survival of migratory bull trout.

The Montana Natural Heritage Program (MNHP) lists 65 animal species of special concern, including 9 mammals and 23 birds, as well as 49 plant species of special concern as occurring in Missoula County (MNHP 2011).

4.4 SOIL EXPOSURE PATHWAY

Soil exposure targets could include a limited number of workers who are conducting salvage operations (e.g., removing equipment) from the industrial core of the mill. The number of current workers on site is unknown, but during the site reconnaissance it appeared to be fewer than 20.

At the time of the site reconnaissance on June 22, 2011, all four sludge ponds as well as the emergency spill pond were completely, or nearly dry. Pond 3 had recently been covered with 10 to 12 inches of wood chips, reportedly for dust control (Marxer 2011). It is feasible that fugitive dust emissions could occur from the surface of uncovered ponds.

After being capped with 18 inches of clay and 6 inches of topsoil, formal closure of the three former landfill areas occurred in September 1995 (MDEQ 1995). These areas are currently largely revegetated.

The nearest residences are located in a small development approximately 0.5 mile east and southeast of the core industrial area (and within 0.25 mile of the mill property boundary). In addition, a ranch that lies within the boundary of the site is located approximately 1 mile due north of the industrial area of the mill site. Access to the core industrial area of the site is controlled, and there were security guards present at the facility entrance during the site reconnaissance. The entire site was not fenced, however, and access could also be gained from the Clark Fork River. Nevertheless, no evidence of public use was noted during the site reconnaissance.

Population within 4 miles of the site is shown in Table 4 below:

TABLE 4
Population within 4 Miles of the Smurfit-Stone Mill Site

Distance from Site	Population (# of persons)
On Site	0
0 – 0.25 Mile	241
>0.25 – 0.5 Mile	218
>0.5 – 1 Mile	85
>1 – 2 Miles	838
>2 – 3 Miles	1,836
>3 – 4 Miles	1,030
Total population within 4 miles	4,248

Source: U.S. Census Bureau 2011.

Threatened and endangered species are described in the Surface Water Pathway section above.

4.5 AIR PATHWAY

The mill site is located in a semiarid climate zone. Prevailing wind direction is from the northwest. It is feasible that particulate contaminants (e.g., from the surface of the dry, uncovered sludge ponds) could be blown off site.

Total wetlands acreage within 4 miles of the mill site boundary is shown in Table 5 below:

TABLE 5
USFWS-Identified Wetlands within 4 Miles of the Smurfit-Stone Mill Site

Distance from Site	Wetlands (acres)
On Site	986
0 – 0.25 Mile	261
>0.25 – 0.5 Mile	84
>0.25 – 1 Mile	260
>1 – 2 Miles	420
>2 – 3 Miles	430
>3 – 4 Miles	227
Total acres within 4 Miles	2,668

Source: USFWS 2011a, National Wetlands Inventory.

Access to the core industrial area of the site is controlled and there were security guards present at the facility entrance during the site reconnaissance. The entire site was not fenced, however, and access could also be gained from the Clark Fork River. The nearest residences are located in a small development approximately 0.5 mile east and southeast of the core industrial area (and within 0.25 mile of the mill property boundary).

5.0 SITE ASSESSMENT FIELD ACTIVITIES

5.1 CONCEPT OF OPERATIONS

5.1.1 Schedule

Field work is tentatively scheduled for the week of October 24, 2011. It is estimated that sampling will take four to five personnel approximately 5 days, with 2 additional days for mobilization and demobilization. A drilling subcontractor utilizing a track-mounted direct push drill rig will be needed to sample subsurface sludge in the ponds and to install up to 10 temporary groundwater wells. It is estimated that the rig will be needed on site for approximately 3 days.

5.1.2 Safety

All field activities will be conducted in strict accordance with an approved UOS Site Health and Safety Plan, which will be developed before the start of field activities. The drilling contractors will operate under their own Health and Safety Plan. It is anticipated that all field work can be accomplished in Level D personal protective equipment (PPE). It is anticipated that all personnel will have to attend a mandatory safety orientation at the facility prior to the commencement of work.

5.1.3 Property Access and Logistics

During the site reconnaissance on June 22, 2011, a site access agreement form was provided to Mr. Mark Spizzo of M2 Green Redevelopment (M2 Green), the current owner of the site. Written consent, in the form of a signed copy of the agreement form, will be required from M2 Green prior to the field sampling event. Written consent will also be required from the owners of the private wells sampled as part of this

investigation. This consent will be requested through letters sent by the EPA prior to the sampling event, and will be confirmed at the time of the sampling.

5.2 SAMPLE LOCATIONS

This site investigation involves the collection of approximately 72 field samples (Figure 2, Table 7). The sampling approach for this investigation is to collect judgmental or biased samples in order to document if an observed release from the site has occurred. As such, sample locations generally have been selected from areas of highest suspected contaminant concentrations (e.g., sludge ponds).

A limited number of opportunity samples may also be collected depending on conditions encountered in the field (e.g., surface soil sampling of previously closed landfill areas if erosion through capping material is noted in the field). Proposed sample locations are shown in Figure 2 and summarized in Table 7.

These samples will potentially include up to:

- 16 surface soil/source samples and 10 subsurface soil/source samples from potential source areas including sludge ponds, the emergency spill pond and background locations;
- 27 groundwater samples (includes 2 background samples) collected from: temporary wells installed during this investigation (up to 10), existing site monitoring/production wells (up to 8), and off-site domestic wells (up to 9); and
- 10 co-located surface water and sediment 'release' samples from the Clark Fork River and O'Keefe Creek (counted as 20 total samples, includes background locations).

All sample points will be located with a GPS device after sample collection. This procedure will allow documentation of changes in sample locations as they occur in the field due to unanticipated site conditions.

Sample locations are discussed in more detail in the sections below:

5.2.1 Surface Soils/Source (0-2 feet bgs)

Two surface soil samples will be collected from each sludge pond (i.e., Ponds 3, 4, 5, and 17), the emergency spill pond (Pond 8, one sample each from the 'dry' and 'wet' cells)

and Pond 2. Three surface soil samples will be collected from the landfarming area with the sample location to be based on visual observations (e.g., surface staining). If no obvious areas of surface staining are found in the landfarm area, immunoassay test kits for total petroleum hydrocarbons (TPH) may be used to define sample locations.

As the landfilled areas on site (e.g., Landfill A) have been covered during closure activities, surface soils from these potential source areas will be collected (as opportunity samples) only if evidence of erosion of the cap into wastes is observed during assessment activities.

5.2.2 Subsurface Soils/Source (> 2 feet bgs)

Two subsurface soil/source samples will be collected from each sludge pond (Ponds 3, 4, 5, and 17) and the emergency spill pond (Pond 8). Additional subsurface soil/source sampling may be conducted at the landfarm area if significant surficial contamination is observed.

5.2.3 Groundwater

Up to 27 groundwater samples will be collected during this assessment. Samples will be collected from temporary wells installed as part of this investigation, from existing site groundwater monitoring wells, and from domestic wells located downgradient from or adjacent to potential source areas of the site.

Of the 27 samples, up to 10 samples will be collected from temporary wells to be installed during this investigation, within and directly downgradient of potential source areas (Figure 2). Although a field of monitoring wells exists on the site, they are generally located some distance from identified potential sources. For example, the closest well to any sludge pond is well SMW-16, located approximately 1,000 feet downgradient of Pond 5 (Figure 2). The closest downgradient wells to the industrial core area are over 3,000 feet away. As such, these 10 temporary wells will be installed within and directly downgradient from potential sources including sludge ponds, the emergency spill pond, and landfill areas (including Landfills A and G), as well as the industrial core area of the mill. These wells will be completed into the upper alluvial aquifer to a depth of approximately 35 feet, depending upon the location of the well.

Six additional groundwater samples will be collected from existing site monitoring wells located both downgradient of potential sources and adjacent to the Clark Fork River (Figure 2). These wells have been targeted as either their location is downgradient of potential sources (although at a farther distance than the temporary wells will be installed, e.g., SMW-19 and SMW-17), and/or they are located adjacent to the Clark Fork River within areas that have shown the highest historical concentrations of mill wastewater components such as sodium and TDS (e.g., SMW-10, SMW-11, SMW-13, SMW-14) (Figure 2). These existing monitoring wells are all completed in the upper alluvial aquifer, with total depths ranging between approximately 30 and 42 feet bgs.

Assuming permission will be granted from landowners, up to 9 domestic wells located downgradient from or adjacent to potential source areas will also be sampled as part of this investigation. Five of these domestic wells were sampled by Hydrometrics in 2001 as part of an investigation into the groundwater mixing zone of the site (Hydrometrics and Inskip 2004). If possible, these five wells will be sampled again for a wider range of potential contaminants (Table 9). Four additional wells have been added for this investigation based on their location down- or crossgradient of potential sources. Two of these four wells were installed after the Hydrometrics sampling in 2001.

According to the Montana Groundwater Information Center, the domestic wells targeted for sampling are all completed in the deeper alluvial aquifer with total depths ranging from 135 to 200 feet bgs (MBMG 2011).

5.2.4 Surface Water and Sediments

Co-located surface water and sediment samples will be collected from locations on both O'Keefe Creek and the Clark Fork River. Locations will be chosen both up- and downgradient of likely source areas. Locations on O'Keefe Creek will target areas adjacent to the former landfarming area, as well as sludge pond 17. Locations on the Clark Fork River will target Outfalls 1, 2, 3 and 4 from the mill, as well as locations adjacent to Ponds 2 and 13 (Figure 2). Upgradient samples will also be collected from both water bodies.

5.2.5 Opportunity Sampling

A limited number of opportunity samples may be collected from various locations across the site if dictated by conditions encountered in the field. Some example conditions would include the sampling of surface soils from Landfills A and G if capping material is found to have eroded and waste is exposed, and the sampling of subsurface soils from the landfarm area if significant surface staining is evident. Approval from the EPA task monitors will be sought prior to the collection of any opportunity samples.

5.3 SAMPLING METHODS

5.3.1 Surface Soils/Source

Surface soil/source samples will be collected in accordance with procedures described in UOS TSOP 4.16, "Surface and Shallow Depth Soil Sampling" (UOS 2005b). All surface soil/source samples will be collected as biased grab samples from the 0- to 2-foot depth interval. Stainless steel soil samplers (e.g., augers or a slam bar with a core sampler) will be used to advance a sampling barrel to 2 feet bgs. At locations within potential source areas where temporary monitoring wells will be installed (e.g., one location per sludge pond), surface soils will be sampled from a sampling core prior to the installation of the well.

Disposable plastic spoons will be used to transfer the soil from the sampling apparatus into appropriate sample containers. After collection, samples will then be stored on ice and held at $< 4^{\circ}\text{C}$. Sample descriptions will be logged in a field log book with standard geologic descriptions. All surface soil/source sampling locations will be photographed and their locations recorded with a GPS.

5.3.2 Subsurface Soils/Source

Given the potential for unstable and unsupportive materials within the ponds, as well as the expected depths of the materials within the ponds (up to 14 feet bgs) a track-mounted direct push drill rig will be used to collect subsurface soil/source samples. Using this method, the rig is used to advance a hollow steel sampling tube which holds a clear plastic liner inside. After being driven to the desired depth, the steel tube is extracted from the subsurface and the liner is removed from the tube. Samples are then collected

from the liner by transferring the soil from the liner into appropriate sampling containers using disposable plastic spoons. This procedure will be in general accordance with UOS TSOP 4.27, “Basic Geoprobe® Operations” (UOS 2005b).

If subsurface materials do not appear to be homogenous, immunoassay test kits may be used to identify potential zones of contamination.

Samples will then be stored on ice and held at $< 4^{\circ}\text{C}$. Sample descriptions will be logged in a field log book with standard geologic descriptions. All surface soil/source sampling locations will be photographed and their locations recorded with a GPS.

5.3.3 Groundwater

Up to 10 temporary groundwater monitoring wells will be installed using a track-mounted direct push drill rig. Groundwater sampling from these wells will be conducted according to those procedures outlined in UOS TSOP 4.12, “Groundwater Sampling” and methods outlined in the UOS TSOP 4.27, “Basic Geoprobe® Operations” (UOS 2005b). Groundwater samples will be collected with a peristaltic pump or disposable Teflon bailers.

Groundwater samples collected from the six existing groundwater monitoring wells will also be collected with a peristaltic pump or disposable bailers. Groundwater samples collected from existing domestic wells will be collected either directly from the well or from a tap located in line prior to any treatment or filtration system.

Before groundwater samples are collected from monitoring wells, groundwater will be purged at least three water column volumes or until the parameters of temperature, pH, and conductivity have stabilized within 10 percent of their relative values according to UOS TSOP 4.14 “Water Sample Field Measurements” (UOS 2005b). Samples will be placed in appropriate sample containers (Table 10). Information regarding the details of sample collection will be entered into a field log book.

All groundwater sampling locations will be photographed and their locations recorded with a GPS.

5.3.4 Surface Water and Sediments

Surface water sampling for total and dissolved metals will be conducted by immersing the sample bottles directly into the sample media in accordance with UOS TSOP 4.18, “Surface Water Sampling” (UOS 2005b). Samples collected for dissolved metals will be filtered in the field by drawing the water through a 0.45 micrometer (μm) filter using either a peristaltic pump fitted with disposable, dedicated tygon tubing, or a hand pump. Water samples will be preserved with nitric acid to a pH of <2 and stored on ice to $<4^{\circ}\text{C}$. UOS will measure field parameters, including pH, temperature, and electrical conductivity of each sample collected, as described in TSOP 4.14 “Water Sample Field Measurements” (UOS 2005b). All field data will be recorded in a field log book. The sample locations will be photographed and documented in a field log book during sampling activities. Wetlands observed in the field will be assessed to determine if they meet the 40 CFR 230.3 Definition of a Wetland; this information will also be entered into a field log book.

Sediment sampling will be conducted according to UOS TSOP 4.17, “Sediment Sampling” (UOS 2005b). Sample locations are shown in Figure 3 and explained in Table 7. Sediment sampling will be conducted using disposable plastic scoops. Sediment samples will be stored on ice to $<4^{\circ}\text{C}$. Sediment sampling locations will be co-located with surface water sampling locations and will be conducted proceeding from the most downstream location to the most upstream location. Soil samples for total metals will be placed in appropriate sample containers. All sediment sample locations will be photographed and documented during sample activities.

All samples will be packaged and shipped in accordance with UOS TSOP 4.4 “Sample Identification, Labeling, and Packaging” (UOS 2005b). All samples will be handled in strict accordance with the chain-of-custody protocol specified in UOS TSOP 4.3, “Chain of Custody” (UOS 2005b). Samples will be identified by assigning a unique sample ID to each sample using the following system:

- All sample IDs will begin with “SS” for Smurfit-Stone,
- “SS” will be followed with a two letter designation signifying the matrix of the sample as follows: “SO” for soil/source, “SE” for sediment, “SW” for surface water, and “GW” for groundwater,

- The matrix designation will be followed by a two-digit sequential number, and
- Soil/source samples will also have an additional designation for the bottom depth (in feet) of the interval collected (e.g., “02” for a surface soil sample).

For example, the fifth subsurface soil collected from sludge pond 17 at an interval of 7 to 8 feet bgs would be identified as SSS00508.

5.4 LABORATORY ANALYSIS METHODS AND ANALYTICAL PARAMETERS

Samples will be analyzed through the EPA CLP for RAS (to include VOCs, SVOCs, TAL Metals, PCBs) and Non-Routine Analytical Services (to include dioxins and furans). A limited number of surface soil and groundwater samples will also be analyzed for asbestos.

All specific sample parameters per matrix are listed in Table 9, the Sample Plan Checklist. Table 10 lists analytical methods and sample-specific container and preservation requirements. In summary, all soil/source, sediment and groundwater samples will be analyzed for VOCs by EPA SOM01.2 (based on EPA Method 8260B), SVOCs by EPA SOM01.2 (based on EPA Method 8270D), TAL Metals (total) by EPA ISM01.2 (based on EPA Method 6010C), PCBs by EPA SOM01.2 (based on EPA Method 8082A), and chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans (CDDs/CDFs) by EPA SOW DLM02.2 (based on EPA Method 1613B or Method 8290).

In addition to the above analyses, all surface water and ground water samples will also be analyzed for dissolved metals by EPA ISM01.2 (based on EPA Method 6010C). A limited number of groundwater and surface soil samples will also be analyzed for asbestos by a private laboratory using EPA Method 600.

5.5 DOCUMENTATION

The START field personnel will also be responsible for maintaining a photolog and field log books. The purpose of the field log book is to document a semi-narrative record of the field conditions, activities, and events relevant to the field program on a daily basis.

UOS personnel will record all groundwater sampling information, including field parameters, sample date, sample time, and any other relevant information, in a field log book.

5.6 CHAIN OF CUSTODY

After sample collection and identification, all samples will be handled in strict accordance with the chain-of-custody protocol specified in UOS TSOP 4.3, "Chain of Custody" (UOS 2005b).

5.7 CONTROL OF CONTAMINATED MATERIALS

Investigation-derived waste (IDW) generated during the SI will be handled in accordance with UOS TSOP 4.8, "Investigation-Derived Waste Management," and the OERR Directive 9345.3-02, "Management of Investigation-Derived Waste During Site Inspections," May 1991 (UOS 2005b; EPA 1991). IDW is expected to include disposable PPE and field equipment including used sampling gloves, used water filters, and bailers; as well as purge water and decontamination water. Used PPE and field equipment will be placed in an industrial dumpster at the site or at the UOS warehouse. As decontamination water and purge water are expected to be non-hazardous, they will be disposed of on site at the sample point in accordance with TSOP 4.8.

6.0 MEASUREMENT QUALITY OBJECTIVES

6.1 FIELD QUALITY CONTROL PROCEDURES

All samples will be handled and preserved as described in UOS TSOP 4.2, "Sample Containers, Preservation, and Maximum Holding Times." Calibration of the pH, temperature, and conductivity meters will follow instrument manufacturers' instruction manuals and UOS TSOP 4.14, "Water Sample Field Measurements." Sample collection will progress from downstream to upstream to prevent cross-contamination (UOS 2005b).

All non-disposable sampling equipment will be decontaminated prior to initial use and after the collection of each sample in accordance with UOS TSOP 4.11, "Equipment Decontamination." Basic decontamination will consist of washing or brushing gross particulate off sampling equipment with containerized tap water and a scrub brush, followed by washing equipment with a solution of Liquinox® and distilled water, then rinsing with distilled water. After decontamination, the equipment will be allowed to gravity drain and then will be wrapped in aluminum foil to minimize potential contamination (UOS 2005b).

The following samples will be collected to evaluate quality assurance at the site in accordance with the "Guidance for Performing Site Inspections under CERCLA," Interim Final September

1992, the “Region 8 Supplement to Guidance for Performing Site Inspections under CERCLA,” and the UOS Generic QAPP (EPA 1992a, 1993; UOS 2005a):

- One rinsate blank for the soil matrix will be collected for the site if non-disposable equipment is used.
- One duplicate aqueous sample per set of 20 aqueous samples collected is required. Two duplicate aqueous samples will be required for this investigation.
- One replicate soil/source sample per set of 20 soil/source samples collected is required. Two replicate soil/source samples will be required for this investigation.
- Additional volumes of a sediment/soil sample and additional volumes of an aqueous sample will be collected for each 20 samples collected to be used for an MS/MSD (the triple volume samples will not be labeled as separate samples).

The UOS Generic QAPP serves as the primary guide for the integration of QA/QC procedures for the START contract (UOS 2005a).

6.2 DATA QUALITY INDICATORS

Data quality assessment to determine data quality and usability will include:

- A QA/QC review of field-generated data and observations;
- Individual data validation reports for all sample delivery groups;
- Review of the procedures used by the validator to qualify data for reasons related to dilution, reanalysis, and duplicate analysis of samples;
- Evaluation of QC samples such as equipment rinsates, field replicates, and matrix spike laboratory control samples to assess the quality of the field activities and laboratory procedures;
- Assessment of the quality of data measured and generated in terms of accuracy, precision, and representativeness; and
- Summary of the usability of the data, based upon the assessment of data conducted during the previous steps.

Quality attributes are qualitative and quantitative characteristics of the collected data. The principle quality attributes to environmental studies are precision, bias, representativeness,

comparability, completeness, and sensitivity. Data quality indicators (DQIs) are specific indicators of quality attributes.

Performance criteria address the collection of samples, and acceptance criteria address the use of the data collected (EPA 2002). Performance and acceptance criteria are documented below:

6.2.1 Bias

Bias is systematic or persistent distortion of a measurement process that causes errors in one direction. The extent of bias can be determined by an evaluation of laboratory initial calibration/continuing calibration verification, laboratory control spike/laboratory control spike duplicates, blank spike, MS/MSD, method blank, and trip blank.

6.2.1 Sensitivity

Sensitivity generally refers to the capability of a method or instrument to discriminate between small differences in analyte concentration. Detection limits and project requirements will be compared in order to select a method with the necessary detection limits to meet the project goals. Data validation will include a review of final reporting limits to determine if matrix issues such as dilution and interferences have affected the usability of the data. Contract required quantitation limits (CRQLs) under the CLP program are listed in Appendix A.

6.2.2 Precision

Precision is the measure of agreement among repeated measurements of the same property under identical, or substantially similar, conditions and is expressed as the relative percent difference (RPD) between the sample pairs. Overall sample precision will be monitored using two duplicates for the water matrix and one replicate for the soil/source. Acceptance criteria in RPD for water is ± 20 percent.

6.2.3 Representativeness

Representativeness is the measure of the degree to which data accurately and precisely represent a characteristic of a population parameter, variations at a sampling point, a process condition, or an environmental condition. Representativeness will be achieved by adherence to TSOPs for sampling procedures, field and laboratory QA/QC procedures,

appropriateness of sample location, and achieving the acceptance criteria laid out in the FSP.

6.2.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system, and is calculated using the formula: *Percent Completeness = (Number of Valid Measurements / Number of Measurements Planned) X 100*. The actual percentage of completeness is less important than the effect of completeness on the data set.

6.2.5 Comparability

Comparability is the qualitative term that expresses the confidence that two data sets can contribute to common interpretation and analysis and is used to describe how well samples within a data set, as well as two independent data sets, are interchangeable. Comparability will be controlled by collecting all samples in one sampling event, in adherence to the FSP.

7.0 DATA QUALITY ASSESSMENT AND REPORTING

A sampling activities report is due to the EPA Task Monitor within 1 month of the sampling trip. An Analytical Results Report (ARR) will be submitted to the EPA Task Monitor within 4 weeks of the receipt of all data from the CLP laboratories. A final revised ARR will be delivered to the EPA Task Monitor within 3 weeks of receipt of EPA comments. A data usability review will be conducted by a START chemist, and data validation, if required, will be conducted by EPA Region 8 or a UOS-contracted validator. The ARR will conform to the "Guidance for Performing Site Inspections under CERCLA," Interim Final September 1992 and the "Region 8 Supplement to Guidance for Performing Site Inspections under CERCLA" (EPA 1992a, 1993).

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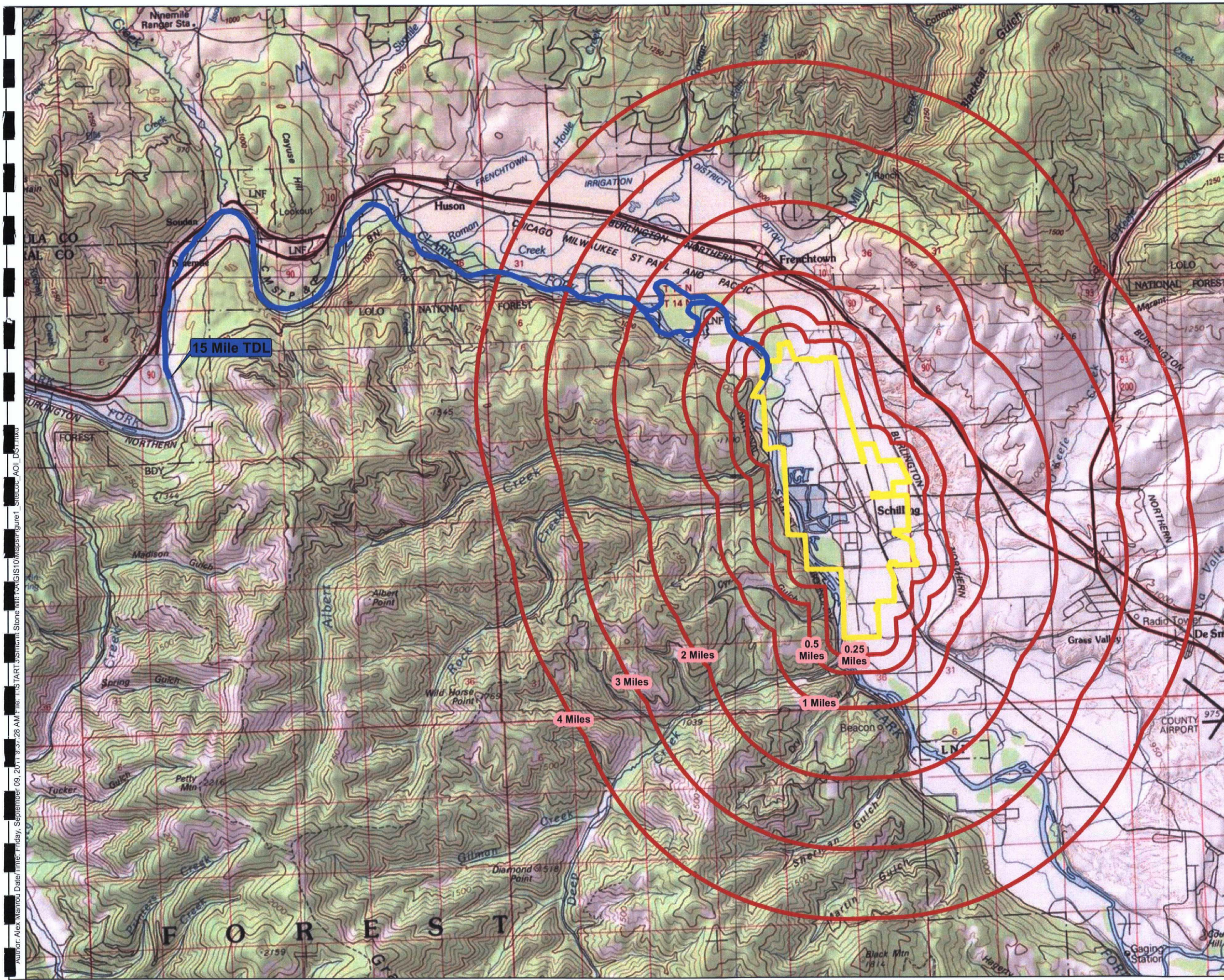
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Legend

- Clark Fork 15 Mile Target Distance Limit
- 4 Mile Area of Influence
- Mill Site Boundary

TDD Title: **Smurfit-Stone Mill RA**

Figure Title: Site Location, Area of Influence, and 15 Mile Downstream Target Distance Limit

Figure No. **1**

TDD State: **MT**

TDD County: **Missoula**

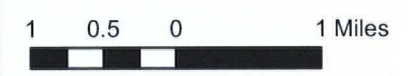
TDD: **1105-09**

Date: **09/2011**

Base Data Source: Bing Maps 2011

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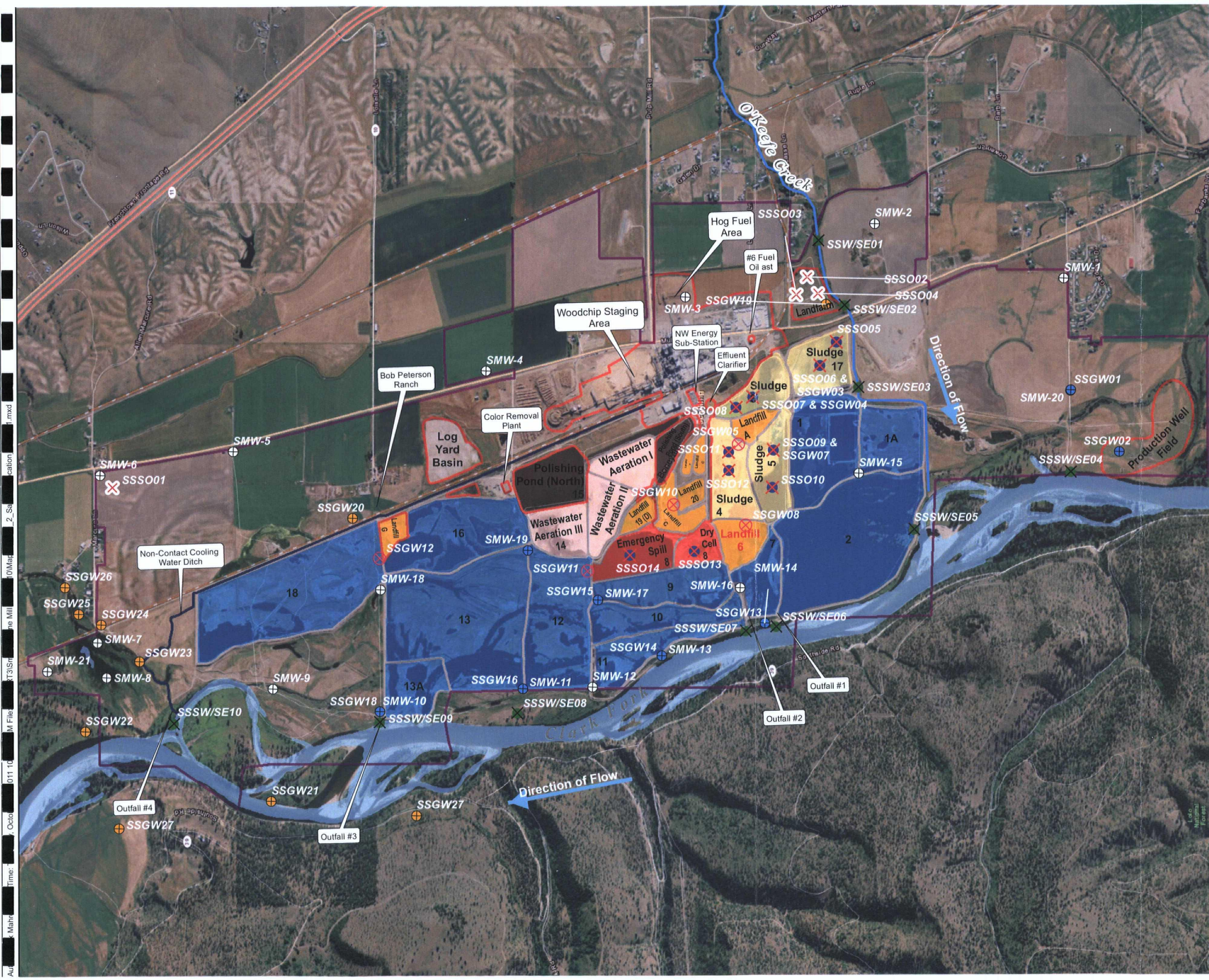
Datum/Projection: NAD 1983 UTM Zone 11N



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Author: Alex Marandou Date: 09/20/11 9:31:28 AM File: I:\START\Smurfit Stone Mill RA\GIS\00mapsrfigure1_SiteLoc_AOI_D01.mxd



Legend

- Wells**
- ⊗ Temporary Geoprobe Well
 - ✕ Surface Soil
 - ⊕ Monitoring Wells
 - ⊗ Geoprobe Surface Subsurface & Groundwater
 - ⊕ Existing Monitoring Well to be Sampled
 - ⊕ Existing Domestic Well to be Sampled
 - ⊗ Co-Located Surface Water / Sediment
- Mill Site Boundary**
- ▭ Mill Site Boundary

Numbered Ponds and Landfills

- ▭ Site Features
- ▭ Landfills
- ▭ Treated Wastewater Storage Ponds
- ▭ Aerated Stabilization Basins Treatment Ponds
- ▭ Polishing Ponds
- ▭ Sludge Ponds
- ▭ Emergency Spill Pond

TDD Title: **Smurfit-Stone Mill RA**

Figure Title: **Sample Location Map**

Figure No. **2**

TDD State: **MT**

TDD County: **Missoula**

TDD: **1105-09**

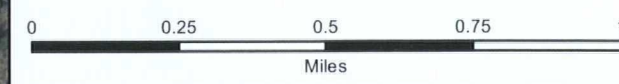
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Datum/Projection: **NAD 1983 UTM Zone 12N**



Page Size: **11x17**



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Figure 3
 Preliminary Conceptual Site Model

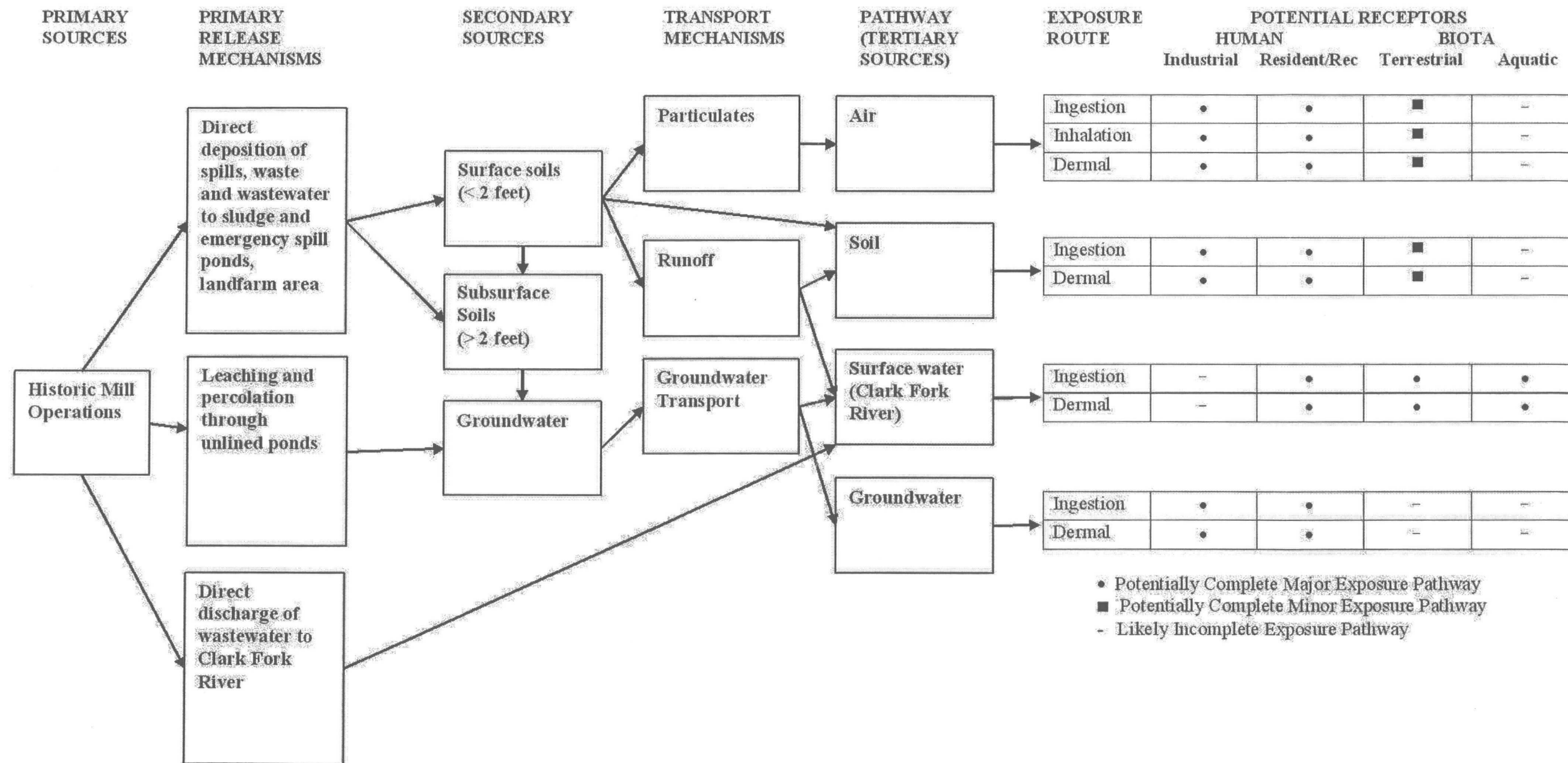


TABLE 6
Data Quality Objectives Seven-Step Planning Approach

Step 1 Problem Statement	Step 2 Identifying the Decisions	Step 3 Decision Inputs	Step 4 Study Boundaries	Step 5 Decisions Rules	Step 6 Tolerance Limits on Errors	Step 7 Optimization of Sample Design
<p>There is a potential for contamination from a former pulp and paper mill to impact the Clark Fork River, O'Keefe Creek, groundwater, and soil adjacent to the mill property.</p> <p>Information on the presence of contamination along exposure pathways and within potential source areas at the former mill is currently unknown.</p> <p>The Clark Fork River is a fishery, and wetlands have been identified along the banks of the creek. Numerous domestic and public supply wells in the vicinity of the former mill use groundwater.</p>	<p>The principal decision to be determined by this Removal Assessment is whether or not there is an immediate risk to groundwater, surface water, and/or human receptors from contamination from the former mill that warrants a removal action and/or further investigation.</p>	<p>The information that is required to arrive at a decision for this site includes:</p> <ul style="list-style-type: none"> Analytical data from source areas to determine the presence and concentration of contaminants. Analytical data from surface water, groundwater, soil, and sediment samples to determine if contaminants from the potential waste sources have migrated into aquifers below the former mill, and/or into the Clark Fork River or O'Keefe Creek; Confirmation of environmental (e.g., wetlands) and human health targets (e.g., people consuming fish) directly or potentially impacted by migration of contaminants from the sources; and Comparison of analytical results to background concentrations and HRS benchmarks. 	<p>The site covers approximately 3,200 acres, of which approximately 1,000 acres may be potential sources (e.g., sludge ponds, an emergency spill pond, a landfarming area). The site is bounded on the west by the Clark Fork River, on the south by O'Keefe Creek, and primarily by agricultural land to the east and north.</p> <p>The downstream limit of the investigation on the Clark Fork River will be the 15 Mile TDL.</p> <p>Approximately 4,000 people reside within 4 miles of the site and source their potable water from groundwater.</p> <p>The pathways of primary concern at the former Smurfit-Stone Mill site are the surface water and groundwater pathways. The soil exposure and air pathways are assumed to be of lesser concern.</p> <p>Potential human health and environmental targets include the population surrounding the former mill, on-site workers, aquatic and wetland environments downstream of the former mill, consumers of fish from the Clark Fork River, and recreational users of the area.</p> <p>Samples to be tested include surface and subsurface soils (from potential sources), surface water and stream sediments downstream from the multiple probable points of entry (PPE) along the Clark Fork River and O'Keefe Creek, and groundwater beneath and downgradient of the potential sources (including from domestic wells).</p>	<p>Results for each sample will be directly compared to site-specific background samples in addition to surface water, groundwater or soil/sediment benchmarks as appropriate (see Appendix A).</p> <p>The EPA and other appropriate agencies (such as the MDEQ) and their representatives will work together to evaluate the site data obtained during field activities to determine if a time-critical removal is warranted, or if additional information is required to characterize the site or migration of the waste from the site.</p> <p>Analytical results will be used to determine a preliminary HRS score for the site.</p>	<p>Samples will be collected to identify potential human health and environmental targets for the various pathways and to determine background concentrations for soils, surface water, groundwater and sediments.</p> <p>Sampling, measurement, and decision errors will be minimized by using standard field and laboratory operating procedures, collecting an appropriate number of quality control samples, meeting standard holding times, and ensuring that samples are representative of site conditions. Sample locations will be biased to collect information from areas with the greatest potential for contamination. Field screening tools (i.e., immunoassay test kits) may be used to achieve this if gross contamination (e.g., staining) is not detected in the field.</p> <p>Sampling activities will adhere to the START TSOPs and the UOS Generic QAPP to ensure data reproducibility. Unless specified otherwise by the EPA task monitor, all data will be validated in accordance with CLP National Functional Guidelines to document data quality.</p>	<p>Sample locations may be field-modified by the project manager or leader of the field sampling crew based upon an understanding of known environmental conditions and additional information obtained during field activities.</p> <p>The potential of collecting opportunity samples if unforeseen contamination is encountered in the field has been included in this FSP (e.g., the erosion of capping over landfilled areas).</p>

TABLE 7
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Soil/Source	SSSO0102	Surface soil grab sample from mill property to the north (upwind) of potential source areas	Determine background surface soil conditions on site.
	SSSO0202	Surface soil/source grab sample from landfarm area (most contaminated location).	Characterize on-site sources and contamination.
	SSSO0302	Surface soil/source grab sample from landfarm area.	Characterize on-site sources and contamination.
	SSSO0402	Surface soil/source grab sample from landfarm area.	Characterize on-site sources and contamination.
	SSSO0502	Surface soil/source grab sample from Sludge Pond 17	Characterize on-site sources and contamination.
	SSSO05xx	Subsurface soil/source grab sample from Sludge Pond 17	Characterize on-site sources and contamination.
	SSSO0602	Surface soil/source grab sample from Sludge Pond 17	Characterize on-site sources and contamination.
	SSSO06xx	Subsurface soil/source grab sample from Sludge Pond 17	Characterize on-site sources and contamination.
	SSSO0702	Surface soil/source grab sample from Sludge Pond 3	Characterize on-site sources and contamination.
	SSSO07xx	Subsurface soil/source grab sample from Sludge Pond 3	Characterize potential on-site sources and contamination.
	SSSO0802	Surface soil/source grab sample from Sludge Pond 3	Characterize potential on-site sources and contamination.
	SSSO08xx	Subsurface soil/source grab sample from Sludge Pond 3	Characterize potential on-site sources and contamination.
	SSSO0902	Surface soil/source grab sample from Sludge Pond 5	Characterize potential on-site sources and contamination.

TABLE 7
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Soil/Source (cont.)	SSSO09xx	Subsurface soil/source grab sample from Sludge Pond 5	Characterize potential on-site sources and contamination.
	SSSO1002	Surface soil/source grab sample from Sludge Pond 5	Characterize potential on-site sources and contamination.
	SSSO10xx	Subsurface soil/source grab sample from Sludge Pond 5	Characterize potential on-site sources and contamination.
	SSSO1102	Surface soil/source grab sample from Sludge Pond 4	Characterize potential on-site sources and contamination.
	SSSO11xx	Subsurface soil/source grab sample from Sludge Pond 4	Characterize potential on-site sources and contamination.
	SSSO1202	Surface soil/source grab sample from Sludge Pond 4	Characterize potential on-site sources and contamination.
	SSSO12xx	Subsurface soil/source grab sample from Sludge Pond 4	Characterize potential on-site sources and contamination.
	SSSO1302	Surface soil/source grab sample from Emergency Spill Pond (8) dry cell.	Characterize potential on-site sources and contamination.
	SSSO13xx	Subsurface soil/source grab sample from Emergency Spill Pond (8) dry cell.	Characterize potential on-site sources and contamination.
	SSSO1402	Surface soil/source grab sample from Emergency Spill Pond (8) wet cell.	Characterize potential on-site sources and contamination.
	SSSO14xx	Subsurface soil/source grab sample from Emergency Spill Pond (8) wet cell.	Characterize potential on-site sources and contamination.
	SSSO1502	Surface soil/source grab sample from Pond 2.	Characterize potential on-site sources and contamination.
	SSSO1602	Surface soil/source grab sample from Pond 2.	Characterize potential on-site sources and contamination.

TABLE 7
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Surface Water and Sediment	SSSW/SE01	Grab sample collected from O'Keefe Creek immediately upstream of the PPE from the landfarm area.	Document background conditions along O'Keefe Creek.
	SSSW/SE02	Grab sample collected from O'Keefe Creek immediately downstream of the PPE from the landfarm area.	Document potential site impacts to the surface water pathway along O'Keefe Creek downstream of the landfarm area.
	SSSW/SE03	Grab sample collected from O'Keefe Creek immediately downstream of Sludge Pond 17.	Document potential site impacts to the surface water pathway along O'Keefe Creek downstream of Sludge Pond 17.
	SSSW/SE04	Grab sample collected from the Clark Fork River immediately upstream of potential source areas of the mill.	Document background conditions along the Clark Fork River.
	SSSW/SE05	Grab sample collected from the Clark Fork River adjacent to Pond 2	Document potential site impacts to the surface water pathway along the Clark Fork River.
	SSSW/SE06	Grab sample collected from the Clark Fork River immediately downstream of Outfall 1.	Document potential site impacts to the surface water pathway along the Clark Fork River downstream of Outfall 1.
	SSSW/SE07	Grab sample collected from the Clark Fork River immediately downstream of Outfall 2.	Document potential site impacts to the surface water pathway along the Clark Fork River downstream of Outfall 2.
	SSSW/SE08	Grab sample collected from Clark Fork River adjacent to Pond 13.	Document potential site impacts to the surface water pathway along the Clark Fork River.
	SSSW/SE09	Grab sample collected from the Clark Fork River immediately downstream of Outfall 3.	Document potential site impacts to the surface water pathway along the Clark Fork River downstream of Outfall 3.
	SSSW/SE10	Grab sample collected from the Clark Fork River immediately downstream of Outfall 4.	Document potential site impacts to the surface water pathway along the Clark Fork River downstream of Outfall 4.

TABLE 7
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Groundwater	SSGW01	Shallow aquifer groundwater grab sample collected from existing monitoring well located upgradient of mill (e.g. SMW-20).	Determine background conditions of groundwater in shallow aquifer.
	SSGW02	Deeper aquifer groundwater grab sample collected from existing production well located upgradient of mill (exact well TBD).	Determine background conditions of groundwater in deeper aquifer.
	SSGW03	Shallow aquifer groundwater grab sample collected from temporary Geoprobe well located within or downgradient of Sludge Pond 17.	Document potential site impacts on shallow groundwater aquifer.
	SSGW04	Shallow aquifer groundwater grab sample collected from temporary Geoprobe well located within or downgradient of Sludge Pond 3.	Document potential site impacts on shallow groundwater aquifer.
	SSGW05	Shallow aquifer groundwater grab sample collected from temporary Geoprobe well located within or downgradient of Landfill A.	Document potential site impacts on shallow groundwater aquifer.
	SSGW06	Shallow aquifer groundwater grab sample collected from temporary Geoprobe well located within or downgradient of Sludge Pond 4.	Document potential site impacts on shallow groundwater aquifer.
	SSGW07	Shallow aquifer groundwater grab sample collected from temporary Geoprobe well located within or downgradient of Sludge Pond 5.	Document potential site impacts on shallow groundwater aquifer.
	SSGW08	Shallow aquifer groundwater grab sample collected from temporary Geoprobe well located within or downgradient of Landfill 6.	Document potential site impacts on shallow groundwater aquifer.
	SSGW09	Shallow aquifer groundwater grab sample collected from temporary Geoprobe well located within or downgradient of Emergency Spill Pond.	Document potential site impacts on shallow groundwater aquifer.

TABLE 7
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Groundwater (cont.)	SSGW10	Shallow aquifer groundwater grab sample collected from temporary Geoprobe well located within or downgradient of Pond 20 (Landfill E).	Document potential site impacts on shallow groundwater aquifer.
	SSGW11	Shallow aquifer groundwater grab sample collected from temporary Geoprobe well located downgradient of aeration basins.	Document potential site impacts on shallow groundwater aquifer.
	SSGW12	Shallow aquifer groundwater grab sample collected from temporary Geoprobe well located within or downgradient of Landfill G.	Document potential site impacts on shallow groundwater aquifer.
	SSGW13	Shallow aquifer groundwater grab sample collected from existing groundwater monitoring well SMW-14 (adjacent to Clark Fork River).	Document potential site impacts on shallow groundwater aquifer.
	SSGW14	Shallow aquifer groundwater grab sample collected from existing groundwater monitoring well SMW-13 (adjacent to Clark Fork River).	Document potential site impacts on shallow groundwater aquifer.
	SSGW15	Shallow aquifer groundwater grab sample collected from existing groundwater monitoring well SMW-17 (downgradient of most potential sources).	Document potential site impacts on shallow groundwater aquifer.
	SSGW16	Shallow aquifer groundwater grab sample collected from existing groundwater monitoring well SMW-11 (adjacent to Clark Fork River).	Document potential site impacts on shallow groundwater aquifer.
	SSGW17	Shallow aquifer groundwater grab sample collected from existing groundwater monitoring well SMW-19 (downgradient of most potential sources).	Document potential site impacts on shallow groundwater aquifer.
	SSGW18	Shallow aquifer groundwater grab sample collected from existing groundwater monitoring well SMW-10 (adjacent to Clark Fork River).	Document potential site impacts on shallow groundwater aquifer.

TABLE 7
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Groundwater (cont.)	SSGW19	Deeper aquifer groundwater grab sample collected from existing domestic well located within landfarm area (Shields well).	Document potential site impacts on deeper groundwater aquifer.
	SSGW20	Deeper aquifer groundwater grab sample collected from existing domestic well located adjacent to Pond 18 (Peterson well).	Document potential site impacts on deeper groundwater aquifer.
	SSGW21	Deeper aquifer groundwater grab sample collected from existing domestic well located downgradient of mill (Linton well).	Document potential site impacts on deeper groundwater aquifer.
	SSGW22	Deeper aquifer groundwater grab sample collected from existing domestic well located downgradient of mill (D and P Lucier well).	Document potential site impacts on deeper groundwater aquifer.
	SSGW23	Deeper aquifer groundwater grab sample collected from existing domestic well located downgradient of mill (K and D Stenerson well).	Document potential site impacts on deeper groundwater aquifer.
	SSGW24	Deeper aquifer groundwater grab sample collected from existing domestic well located downgradient of mill (D and L Nielsen well).	Document potential site impacts on deeper groundwater aquifer.
	SSGW25	Deeper aquifer groundwater grab sample collected from existing domestic well located downgradient of mill (DL Stenerson well).	Document potential site impacts on deeper groundwater aquifer.
	SSGW26	Deeper aquifer groundwater grab sample collected from existing domestic well located downgradient of mill (D and L Lucier well).	Document potential site impacts on deeper groundwater aquifer.
	SSGW27	Deeper aquifer groundwater grab sample collected from existing domestic well located downgradient of mill (Clark Fork Cattle Ranch well).	Document potential site impacts on deeper groundwater aquifer.

TABLE 7
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
QA/QC (water)	SSGW89	Duplicate of sample SSGW10. (MS/MSD will also be collected here. 3 x volume for water)	Document the precision of sample collection procedures and laboratory analysis.
	SSGW99	Duplicate of sample SSGW20.	Document the precision of sample collection procedures and laboratory analysis.
QA/QC (soil/sludge/sediment)	SSSO89	Replicate of SSSO1002. (MS/MSD will also be collected here (2 x volume for sludge).	Document the precision of sample collection procedures and laboratory analysis.
	SSSE99	Replicate of SSSE10. (MS/MSD will also be collected here (2 x volume for sediment).	Document the precision of sample collection procedures and laboratory analysis.
QA/QC (blanks)	SSSW89	Rinsate blank.	Document thoroughness of decontamination procedures.
	SSSW99A, B, C	Trip blanks.	Document cross-contamination of VOC samples.

TABLE 8
Non-Sampling Data Collection Rationale

Data Element	Data Collection Strategy and Rationale
Sensitive Environments	Locate, estimate, and photograph any wetlands observed, meeting the 40 CFR 230.3 definition on site and downstream of the site along the Clark Fork River.
Historical Data	Acquire historical data (if not already gathered as part of PA research) from MDEQ.
Source Volume Estimates	Acquire more accurate estimates of source volumes using information gathered during soil coring and groundwater well installation.
Soil Exposure Pathway	Identify closest residences to site and observe indicators or evidence of terrestrial sensitive environments or threatened and endangered species. Determine number of workers, recreationists, and residents regularly on the site, if any.
Surface Water Pathway	Document evidence of fishing and consumption of fish.

TABLE 9
Sample Plan Checklist

Sample Location	Sample Type	Field Parameters			Analysis							Quality Control Samples		
		Temp	pH	Cond	PCBs	Dioxins/ Furans	VOCs	SVOCs	Total Metals	Dissolved Metals	Asbestos	Dup/ Rep	Spike	Blank
SSSO0102	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO0202	Soil/Source	-	-	-	X	X	X	X	X	-	X	-	-	-
SSSO0302	Soil/Source	-	-	-	X	-	X	X	X	-	X	-	-	-
SSSO0402	Soil/Source	-	-	-	X	-	X	X	X	-	-	-	-	-
SSSO0502	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO05xx	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO0602	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO06xx	Soil/Source	-	-	-	X	-	X	X	X	-	-	-	-	-
SSSO0702	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO07xx	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO0802	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO08xx	Soil/Source	-	-	-	X	-	X	X	X	-	-	-	-	-
SSSO0902	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO09xx	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO1002	Soil/Source	-	-	-	X	X	X	X	X	-	-	X	X	-
SSSO10xx	Soil/Source	-	-	-	X	-	X	X	X	-	-	-	-	-
SSSO1102	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO11xx	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO1202	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO12xx	Soil/Source	-	-	-	X	-	X	X	X	-	-	-	-	-

TABLE 9
Sample Plan Checklist

Sample Location	Sample Type	Field Parameters			Analysis							Quality Control Samples		
		Temp	pH	Cond	PCBs	Dioxins/ Furans	VOCs	SVOCs	Total Metals	Dissolved Metals	Asbestos	Dup/ Rep	Spike	Blank
SSSO1302	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO13xx	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO1402	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO14xx	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO1502	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSO1602	Soil/Source	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSW01	Surface Water	X	X	X	X	X	X	X	X	X	-	-	-	-
SSSE01	Sediment	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSW02	Surface Water	X	X	X	X	X	X	X	X	X	-	-	-	-
SSSE02	Sediment	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSW03	Surface Water	X	X	X	X	X	X	X	X	X	-	-	-	-
SSSE03	Sediment	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSW04	Surface Water	X	X	X	X	X	X	X	X	X	-	-	-	-
SSSE04	Sediment	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSW05	Surface Water	X	X	X	X	X	X	X	X	X	-	-	-	-
SSSE05	Sediment	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSW06	Surface Water	X	X	X	X	X	X	X	X	X	-	-	-	-
SSSE06	Sediment	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSW07	Surface Water	X	X	X	X	X	X	X	X	X	-	-	-	-
SSSE07	Sediment	-	-	-	X	X	X	X	X	-	-	-	-	-

TABLE 9
Sample Plan Checklist

Sample Location	Sample Type	Field Parameters			Analysis							Quality Control Samples		
		Temp	pH	Cond	PCBs	Dioxins/ Furans	VOCs	SVOCs	Total Metals	Dissolved Metals	Asbestos	Dup/ Rep	Spike	Blank
SSSW08	Surface Water	X	X	X	X	X	X	X	X	X	-	-	-	-
SSSE08	Sediment	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSW09	Surface Water	X	X	X	X	X	X	X	X	X	-	-	-	-
SSSE09	Sediment	-	-	-	X	X	X	X	X	-	-	-	-	-
SSSW08	Surface Water	X	X	X	X	X	X	X	X	X	-	-	-	-
SSSE10	Sediment	-	-	-	X	X	X	X	X	-	-	X	X	-
SSGW01	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW02	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW03	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW04	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW05	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW06	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW07	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW08	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW09	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW10	Groundwater	X	X	X	X	X	X	X	X	X	X	X	X	-
SSGW11	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW12	Groundwater	X	X	X	X	X	X	X	X	X	X	-	-	-
SSGW13	Groundwater	X	X	X	X	-	X	X	X	X	-	-	-	X
SSGW14	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-

TABLE 9
Sample Plan Checklist

Sample Location	Sample Type	Field Parameters			Analysis							Quality Control Samples		
		Temp	pH	Cond	PCBs	Dioxins/ Furans	VOCs	SVOCs	Total Metals	Dissolved Metals	Asbestos	Dup/ Rep	Spike	Blank
SSGW15	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW16	Groundwater	X	X	X	X	-	X	X	X	X	-	-	-	-
SSGW17	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW18	Groundwater	X	X	X	X	-	X	X	X	X	-	-	-	-
SSGW19	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW20	Groundwater	X	X	X	X	X	X	X	X	X	-	X	X	-
SSGW21	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW22	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW23	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW24	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW25	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW26	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW27	Groundwater	X	X	X	X	X	X	X	X	X	-	-	-	-
SSGW89	QA/QC	X	X	X	X	X	X	X	X	X	-	X	X	-
SSGW99	QA/QC	X	X	X	X	X	X	X	X	X	-	X	-	-
SSSO89	QA/QC	-	-	-	X	X	X	X	X	-	-	X	X	-
SSSE99	QA/QC	-	-	-	X	X	X	X	X	-	-	X	X	-
SSSW89	QA/QC	-	-	-	X	X	X	X	X	-	-	-	-	X

TABLE 9
Sample Plan Checklist

Sample Location	Sample Type	Field Parameters			Analysis							Quality Control Samples		
		Temp	pH	Cond	PCBs	Dioxins/ Furans	VOCs	SVOCs	Total Metals	Dissolved Metals	Asbestos	Dup/ Rep	Spike	Blank
SSSW99A, B, C... (one for each cooler)	QA/QC	-	-	-	-	-	X	-	-	-	-	-	-	X

TABLE 10
Sample Container Types, Volumes, and Sample Preservation

Sample Matrix	Analysis	Analytical Method Number	Required Detection Limits ¹	Units ²	Container Number and Type ³	Container Volume	Preservation ⁴	Technical Holding Time ⁵
Soil/Source and Sediment	TAL Total Metals	EPA ISM01.2 (based on EPA Method 6010C via AES or 6020 via MS)	AES – 0.5-500 MS – 0.5-2.5	mg/kg	1 – HDPE jar	4 ounces	Cool to 4° C	6 months
	VOCs	CLP-SOM01.2 (based on EPA Method 8260B)	Low- 5-100 Med – 250-5,000	µg/kg	2-amber glass jar (or 1-En Core samplers)	4 ounces	Cool to 4° C	14 days
	SVOCs and PCBs	EPA SOM01.2 (based on EPA Method 8270D); EPA SOM01.2 (based on EPA Method 8082A)	Low – 170-330 Med – 5,000-10,000 33 (PCBs)	µg/kg	1-amber glass jar	8 ounces	Cool to 4° C	7 days for either
	Dioxins/furans	EPA (based on EPA Methods 1613B, 8290 (high res.) or 8280 (low res.))	1-10	ng/kg	1-amber glass jar	8 ounces	Cool to 4° C	30 days
	Asbestos	Polarized light microscopy (PLM) (based on EPA-600/M4-82-020)	na	%	1-plastic bag	4 ounces	none	none
Surface Water and Groundwater	TAL Total and Dissolved Metals	EPA ISM01.2 (based on EPA Method 6010C via AES or 6020 via MS)	AES – 5-5,000 MS – 1-500	µg/L	2 – HDPE	1 liter	Cool to 4° C; Nitric Acid to pH <2	6 months
	VOCs	CLP-SOM01.2 (based on EPA Method 8260B)	Trace – 0.5-5.0 Low – 5-100	µg/L	3-amber glass 40mL vials	40 mL	Cool to 4° C; HCl acid to pH<2	14 days
	SVOCs	EPA SOM01.2 (based on EPA Method 8270D)	5 - 10	µg/L	2 – amber glass bottle	1 liter	Cool to 4° C;	7 days
	Dioxins/furans	EPA (based on EPA Methods 1613B, 8290 (high res.), or 8280 (low res.))	10-100	pg/kg	2 – amber glass bottle	1 liter	Cool to 4° C; NaS ₂ O ₃	30 days
	PCBs	EPA SOM01.2 (based on EPA Method 8082A)	1.0	µg/L	2 – amber glass bottle	1 liter	Cool to 4° C;	7 days
	Asbestos	Polarized light microscopy (PLM) (based on EPA-600/M4-82-020)	7 million asbestos fibers	Million fibers/L	1-amber glass jar	1 liter	Cool to 4° C	none

¹ Detection limits are presented in this table as ranges. Values are based on method specifications and on project DQOs. See Appendix A for detection limits for specific compounds. AES = atomic emission spectroscopy. MS = mass spectrometry.

² mg/kg = milligrams per kilogram, µg/kg = micrograms per kilogram, ng/kg = nanograms per kilogram, pg/kg = pictograms per kilogram

³ Recommended container types: HDPE = high density polyethylene bottle and cap

⁴ Preserve the samples as soon as they are collected. Add required preservatives to filtered samples following filtration. Completely fill containers used for volatile organic samples, permitting no head space.

⁵ Technical holding times are determined by method and by matrix.

APPENDIX A

Select Analytes Compared to CRQLs, EPA RSLs, SCDMs Benchmarks and MDEQ Standards

Drinking Water Benchmarks

Substance name	CLP Reporting Limits (CRQL)		SCDM (Drinking Water) (1/28/2004)			CAS Number	Sorting Number	EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites- Tapwater** (June 2011) (µg/L)			Circular DEQ-7 Montana Numeric Water Quality Standards (August 2010) (µg/L)							Montana DEQ Tier I Groundwater RBSLs and Standards (September 2009) (µg/L)
	Water (µg/L) (1/2008)	Low Concentration Org. Analytes for Superfund (µg/L) (1/2008)	MCL/ MCLG (µg/L)	RDSC (µg/L)	CRSC (µg/L)			Aquatic Life Standards		BCF	Human Health Standards		Trigger Value	Required Reporting Value				
								Acute	Chronic		Surface Water	Groundwater						
VOLATILE ORGANIC COMPOUNDS (VOCs)																		
Chloromethane (Methyl chloride)	5.0	0.5				74-87-3	001a	190					3.75	30	30	0.08	-	
Acetone	10	5.0		33,000		67-64-1	006	22,000										
Carbon Disulfide	5.0	0.5		3,700		75-15-0	007	1,000										
Chlorobenzene	5.0	0.5	100	730		108-90-7	030	91	100				10.3	100	100	0.5	0.5	
Chloroform	5.0	0.5		360		67-66-3	011	130	80	0.19			3.75	57	70	N/A	0.5	
SEMIVOLATILE ORGANIC COMPOUNDS																		
Phenol	5.0	-		11,000		108-95-2	034b	11,000					1.4	300	300	100	10	
Chlorophenol, 2-	5.0	-				95-57-8	036	180					134	81	81	0.3	0	
Dichlorophenol, 2,4-	5.0	-		110		120-83-2	050	110					40.7	77	77	10	10	
Naphthalene	5.0	0.10		1,500		91-20-3	052	6.2		0.14			10.5	100	100	0.04	10	100 n
Trichlorophenol, 2,4,5-	5.0	-				95-95-4	059	3,700					110	7	7	10	10	
Trichlorophenol, 2,4,6-	5.0	-			7.7	88-06-2	058	37		6.1			150	14	30	N/A	10	
Pentachlorophenol (PCP)	10	0.20	1.0	1,100	0.71	87-86-5	079	180	1.0	0.17	5.3 ⁽¹⁴⁾	4 ⁽¹⁴⁾	11	1	1	N/A	0.05	
Phenanthrene	5.0	0.10				85-01-8	080						30	-	-	0.01	0.25	
AROCLORS																		
Aroclor-1016	1.0					12674-11-2	119	2.6		0.96		0.014	31,200	0.00064	0.5	N/A	1	
Aroclor-1221	1.0					11104-28-2	120			0.0068		0.014	31,200	0.00064	0.5	N/A	1	
Aroclor-1232	1.0					11141-16-5	121			0.0068		0.014	31,200	0.00064	0.5	N/A	1	
Aroclor-1242	1.0					53469-21-9	122			0.034		0.014	31,200	0.00064	0.5	N/A	1	
Aroclor-1248	1.0					12672-29-6	123			0.034		0.014	31,200	0.00064	0.5	N/A	1	
Aroclor-1254	1.0					11097-69-1	124	0.34		0.73		0.014	31,200	0.00064	0.5	N/A	1	
Aroclor-1260	1.0					11096-82-5	125			0.034		0.014	31,200	0.00064	0.5	N/A	1	
PCBs (Polychlorinated biphenyls)	1.0		0.50	0.73	0.043	1336-36-3	127					0.014	31,200	0.00064	0.5	N/A	1	
DIOXINS / FURANS																		
TCDD, 2, 3, 7, 8,	0.00001		0.00003		0.00000057	1746-01-6		0.00000052	0.00003	0.000037								
TCDF, 2, 3, 7, 8,	0.00001				0.0000057	51207-31-9												
Heptachlorodibenzo-p-dioxin 1,2,3,4,6,7,8- (1,2,3,4,6,7,8-HpCDD)	0.00005				0.00057	35822-46-9	172											
Heptachlorodibenzofuran 1,2,3,4,6,7,8- (1,2,3,4,6,7,8-HpCDF)	0.00005				0.00057	67562-39-4	173											
Heptachlorodibenzofuran 1,2,3,4,7,8,9- (1,2,3,4,7,8,9-HpCDF)	0.00005				0.00057	55673-89-7	174											
Pentachlorodibenzofuran 2,3,4,7,8- (2,3,4,7,8-PeCDF)	0.00005				0.0000057	57117-31-4	175											
INORGANIC (See SCDM Dissolved Metals Note)																		
	ICP-AES /	ICP-MS (CRDL)																
Arsenic	10	1	10	11	0.057	7440-38-2	203	0.045	10	11	340	150	44	10	10	N/A	3	
Cadmium	5	1	5.0	18		7440-43-9	206	18	5.0		0.52 *	0.097 *	64	5	5	0.1	0.08	
Asbestos			7 million fibers/L			1332-21-4	225				-	-	-	7 mil. fibers/L	7 million fibers/L	N/A	-	

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* @ 25 mg/L hardness (Aquatic Life Standards Montana Circular DEQ7 – see footnote 12 for hardness relationship)

** Regional Screening Levels are subject to frequent change.





*** The best achievable practical quantitation limit (1 µg/L) may be greater than the human health standard therefore, if the compound is detected, additional evaluation may be necessary.

(10) (See Montana DEQ-7 Numeric Water Quality Standards footnotes.) The Required Reporting Value(s) (RRV) for Dioxin and congeners are to be the best detection level for the analysis method approved by the Montana DEQ.

(14) Freshwater Aquatic Life Standard for pentachlorophenol with pH. Values correspond to a pH of 6.5 and are calculated as follows: Acute=exp [1.005(pH) – 4.869] Chronic =exp [1.005(pH) – 5.134].

(21) Based on taste and odor thresholds given in EPA 823-F-97-008 December 1997.

(23) The concentration of iron must not reach values that interfere with the uses specified in the surface and groundwater standard. The Secondary Maximum Contaminant Level of 300 micrograms per liter, which is based on aesthetic properties such as taste, odor and staining, may be considered as guidance to determine the levels that will interfere with the specified uses.

(24)	The concentration of manganese must not reach values that interfere with the uses specified in the surface and groundwater standards. The Secondary Maximum Contaminant Level of 50 micrograms per liter, which is based on aesthetic properties such as taste, odor, and staining, may be considered as guidance to determine the levels that will interfere with the specified uses.
(29)	Groundwater human health standard is based on the relative potency for selected PAH compounds listed in Table 8 of the EPA "Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons" July 1993, EPA/600/R-93-089. (Circular DEQ-7 Montana Numeric Water Quality Standards.)
BCF	Bioaccumulation Factor (Montana Circular DEQ-7 Numeric Water Quality Standards).
N/A	Not applicable.
SCDM	Superfund Chemical Data Matrix
RDSC	Reference Dose Screening Concentration
CRSC	Cancer Risk Screening Concentration
RBSL	Risk-Based Screening Level
MCLG	Maximum Contaminant Level Goal. A non-enforceable health goal that is set at a level at which no known or anticipated adverse effect on the health of persons is anticipated which allows an adequate margin of safety.
MCL	Maximum Contaminant Level. The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLG as feasible using the best available analytical and treatment technologies and taking cost into consideration. MCLs are enforceable standards.
Trigger	Trigger values are used to determine if a given increase in the concentration of toxic parameters is significant or not significant as per the nondegradation rules.
CRQL	Contract Required Quantitation Limit (for organic analytes).
CRDL	Contract Required Detection Limit (for inorganic analytes).
ICP-AES	Inductively coupled plasma Atomic Emission Spectroscopy
ICP-MS	ICP-Mass Spectrometry
	Lower than Contract Laboratory Program (CLP) Contract Required Quantitation Limit (CRQL) and below the CLP Low Concentration CRQL.
	Lower than the standard CLP CRQL but above the CLP Low Concentration CRQL.
	For Inorganics: Lower than CLP ICPAES CRDL and below or equal to the CLP ICPMS CRDL.
	For Inorganics: Lower than the CLP ICPAES CRDL but above the ICPMS CRDL.
c	Carcinogenic and direct contact RBSLs are based on a cancer risk of 1×10^{-5} . (Montana DEQ Tier 1 Groundwater RBSLs and Standards.)
n	Non carcinogenic and direct contact RBSLs are based on a hazard quotient of 1. (Montana DEQ Tier 1 Groundwater RBSLs and Standards.)
†	EPA Region 3 RBC Table lists Bis(2-chloro-1-methylethyl) ether with CAS number 10860-1. Previously in SCDM Bis(2-chloroisopropyl) ether was listed as CAS number 39638-32-9 and CAS number 108-60-1 was listed as 2,2'-oxybis(1-Chloropropane). In Montana DEQ-7 the listing for Bis(2-Chloroisopropyl) Ether (CAS No. 108-60-1) also contains 2,2'-oxybis(1-Chloropropane) (CAS No. 39638-32-9).
††	Note on uranium in the Region 9 PRGs: Chemical toxicity only. In the Region 3 RBCs there are two values: 7.3 N µg/L (soluble salts; provisional) and 110 N µg/L (soluble salts; from IRIS).
†††	Region 9 PRGs for Tap Water: Note on manganese: "Non-Standard Method Applied. (See User's Guide.)"
n	non-carcinogenic effect
nc	Non cancer
ca	Cancer
SL	Screening level
ca*	Where: nc SL < 100X ca SL
ca**	Where nc SL < 10X ca SL
max	Concentration may exceed ceiling limit (See Region 3 RBCs User's Guide)





SCDM Dissolved Metals Note: Check the "Conversion Factors for Dissolved Metals" on pages 31 and 32 of the SCDM Hazardous Substance Benchmarks, Hazardous Substance Footnotes dated January 28, 2004.

Sources: EPA 2008 (CLP limits); EPA 2004 (SCDM); EPA 2008 (Low Concentration Detection Limits); EPA 2008 (Region 9 PRGs); Montana DEQ 2010 (Circular DEQ-7 Montana Numeric Water Quality Standards); Montana DEQ 2007 (Tier I Groundwater RBSLs and Standards, Table 3); EPA 2011 (Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites).

Surface Water Benchmarks

Substance name	CLP Limits		SCDM Surface Water (1/28/2004)			SCDM Food Chain (Fish Tissue only) (1/28/2004)			SCDM Environmental (1/28/2004)				CAS Number	Sorting Number	Circular DEQ-7 Montana Numeric Water Quality Standards (August 2010) (µg/L)						
	Water (µg/L) 1/2008	Low Concentration Org. Analytes for Superfund (µg/L) 1/2008	MCL/ MCLG (µg/L)	RDSC (µg/L)	CRSC (µg/L)	FDAAL (ppm)	RDSC (µg/kg)	CRSC (µg/kg)	Fresh Water		Salt Water				Aquatic Life Standards		BCF	Human Health Standards		Trigger Value	Required Reporting Value
									Acute (µg/L)	Chronic (µg/L)	Acute (µg/L)	Chronic (µg/L)			Acute	Chronic		Surface Water	Ground-water		
VOLATILE ORGANIC COMPOUNDS (VOCs)																					
Chloromethane (Methyl chloride)	5.0	0.5											74-87-3	001a			3.75	30	30	0.08	
Acetone	10	5.0		33,000			1,200,000						67-64-1	006							
Carbon Disulfide	5.0	0.5		3,700			140,000						75-15-0	007							
Chloroform	5.0	0.5		360			14,000						67-66-3	011			3.75	57	70	N/A	0.5
Chlorobenzene	5.0	0.5	100	730			27,000						108-90-7	030			10.3	100	100	0.5	0.5
SEMIVOLATILE ORGANIC COMPOUNDS																					
Phenol	5.0			11,000			410,000						108-95-2	034b			1.4	300	300	100	10
Chlorophenol, 2-	5.0												95-57-8	036			134	81	81	0.3	10
Dichlorophenol, 2, 4-	5.0			110			4,100						120-83-2	050			40.7	77	77	10	10
Naphthalene	5.0	0.10		1,500			54,000						91-20-3	052			10.5	100	100	0.04	10
Trichlorophenol, 2,4,6-	5.0				7.7			290					88-06-2	058			150	14	30	N/A	10
Trichlorophenol, 2,4,5-	5.0												95-95-4	059			110	7	7	10	10
Pentachlorophenol (PCP)	10	0.20	1.0	1,100	0.71		41,000	26	19 ^Y	15 ^Y	13 ^Y	7.9 ^Y	87-86-5	079	5.3 ⁽¹⁴⁾	4 ⁽¹⁴⁾	11	1	1	N/A	0.05
Phenanthrene	5.0	0.10											85-01-8	080			30			0.01	0.25
AROCLORS																					
Aroclor-1016	1.0												12674-11-2	119		0.014	31,200	0.00064	0.5	N/A	1
Aroclor-1221	1.0												11104-28-2	120		0.014	31,200	0.00064	0.5	N/A	1
Aroclor-1232	1.0												11141-16-5	121		0.014	31,200	0.00064	0.5	N/A	1
Aroclor-1242	1.0												53469-21-9	122		0.014	31,200	0.00064	0.5	N/A	1
Aroclor-1248	1.0												12672-29-6	123		0.014	31,200	0.00064	0.5	N/A	1
Aroclor-1254	1.0												11097-69-1	124		0.014	31,200	0.00064	0.5	N/A	1
Aroclor-1260	1.0												11096-82-5	125		0.014	31,200	0.00064	0.5	N/A	1
PCBs (Polychlorinated biphenyls)	1.0		0.50	0.73	0.043		27	1.6		0.014 ^Y		0.030 ^Y	1336-36-3	127		0.014	31,200	0.00064	0.5	N/A	1
DIOXINS / FURANS																					
TCDD, 2, 3, 7, 8	0.00001		0.00003		0.00000057			0.000021					001746-01-6								
TCDF, 2, 3, 7, 8	0.00001				0.0000057			0.00021					051207-31-9								
Heptachlorodibenzo-p-dioxin 1,2,3,4,6,7,8- (-HpCDD)	0.00005				0.00057			0.021					35822-46-9	172							
Heptachlorodibenzofuran 1,2,3,4,6,7,8- (-HpCDF)	0.00005				0.00057			0.021					67562-39-4	173							
Heptachlorodibenzofuran 1,2,3,4,7,8,9- (-HpCDF)	0.00005				0.00057			0.021					55673-89-7	174							
Pentachlorodibenzofuran 2,3,4,7,8- (-PeCDF)	0.00005				0.0000057			0.00021					57117-31-4	175							
INORGANIC (See SCDM Dissolved Metals Note)																					
ICP-AES	ICP-MS																				
Arsenic	10	1	10	11	0.057		410	2.1	340 ^Y	150 ^Y	69 ^Y	36 ^Y	7440-38-2	203	340	150	44	10	10	N/A	3
Cadmium	5	1	5.0	18			680		2.0 ^Y	0.25 ^Y	4.0 ^Y	8.8 ^Y	7440-43-9	206	0.52*	0.097*	64	5	5	0.1	0.08

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* @ 25 mg/L hardness (Aquatic Life Standards Montana Circular DEQ7 – see footnote 12 for hardness relationship)
Y Check the footnotes for this value in SCDM Data Version 1/27/2004 (EPA 2004).
(10) (See Montana DEQ-7 Numeric Water Quality Standards footnotes.) The Required Reporting Value(s) (RRV) for Dioxin and congeners are to be the lowest detection level for the analysis method approved by the Montana DEQ.
(14) Freshwater Aquatic Life Standard for pentachlorophenol with pH. Values correspond to a pH of 6.5 and are calculated as follows: Acute = exp[1.005(pH)-4.869] Chronic = exp[1.005(pH)- 5.134].
(21) Based on taste and odor thresholds given in EPA 823-F-97-008 December 1997.
(23) The concentration of iron must not reach values that interfere with the uses specified in the surface and groundwater standards. The Secondary Maximum Contaminant Level of 300 micrograms per liter, which is based on aesthetic properties such as taste, odor, and staining, may be considered as guidance to determine the levels that will interfere with the specified uses.
(24) The concentration of manganese must not reach values that interfere with the uses specified in the surface and groundwater standards. The Secondary Maximum Contaminant Level of 50 micrograms per liter, which is based on aesthetic properties such as taste, odor, and staining, may be considered as guidance to determine the levels that will interfere with the specified uses.
(29) Groundwater human health standard is based on the relative potency for selected PAH compounds listed in Table 8 of the EPA “Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons” July 1993, EPA/600/R-93-089. (Circular DEQ-7 Montana Numeric Water Quality Standards)
BCF Bioaccumulation Factor (Montana Circular DEQ-7 Numeric Water Quality Standards).
N/A Not applicable or not analyzed
SCDM Superfund Chemical Data Matrix.
RDSC Reference Dose Screening Concentration.

CRSC	Cancer Risk Screening Concentration
FDAAL	Food and Drug Administration Action Level
MCLG	Maximum Contaminant Level Goal. A nonenforceable health goal that is set at a level at which no known or anticipated adverse effect on the health of persons could occur which allows an adequate margin of safety.
MCL	Maximum Contaminant Level. The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLG as feasible using the best available analytical and treatment technologies and taking cost into consideration. More enforceable standards.
Trigger	Trigger values are used to determine if a given increase in the concentration of toxic parameters is significant or insignificant as per the nondegradation rules.
ICP-AES	Inductively coupled plasmaAtomic Emission Spectroscopy.
ICP-MS	ICP-Mass Spectrometry.
	Lower than the Contract Laboratory Program (CLP) Contract Required Quantitation Limit (CRQL) and the CLP Low Concentration CRQL.
	Lower than the standard CIP CRQL but above the CLP Low Concentration CRQL.
	For Inorganics: Lower than the CLP ICP-AES Contract Required Detection Limit (CRDL) and the CLP ICPMS CRDL.
	Lower than the CIP ICP-AES CRDL but above the ICP-MS CRDL.
Note:	Values in SCDM Food Chain standards are not shaded because fish tissue sample results are not comparable to CLP limits for water.
SL	Screening levels
ca	Cancer
ca*	Where: nc SL < 100X ca SL
ca**	Where nc SL < 10X ca SL
max	Concentration may exceed ceiling limit (See Region 3 RBCs User's Guide)
nc	Non cancer

SCDM Dissolved Metals Note: Check the "Conversion Factors for Dissolved Metals" on pages 31 and 32 of the SCDM Hazardous Substance Benchmarks, Hazardous Substance Footnotes dated January 28, 2004.

Sources: EPA 2003 (CLP limits); EPA 2004 (SCDM); EPA 2008 (Low Concentration Detection Limits); EPA 2011 (Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs)); Montana DEQ 2010 (Circular DEQ-7, Montana Numeric Water Quality Standards).

Substance name	CLP Reporting Limits (CRQL)	SCDM Soil (January 28, 2004)		CAS Number	Sorting Number	EPA Regional Screening Levels (June 2011) (mg/kg)				SSLs Generic (mg/kg)	Montana Tier 1 RBCA Default RBSLs* 10 to 20 ft to Groundwater (mg/kg) (September 2009)			
	Soil (mg/kg) (9/12/2008)	RDSC (mg/kg)	CRSC (mg/kg)			Soil		Protection for Groundwater Migration - SSLs		Migration to Groundwater (DAF 1) (EPA 2002)	Residential Surface Soil	Commercial Surface Soil	Subsurface Soil	
														Industrial
VOLATILE ORGANIC COMPOUNDS (VOCS)														
Chloromethane	0.005			74-87-3	001a	500 n	120 n	0.049						
Acetone	0.010	70,000		67-64-1	006	630,000 nms	61,000 n	4.5		0.8				
Carbon Disulfide	0.005	7,800		75-15-0	007	3,700 ns	820 ns	0.31		2.0				
Chloroform	0.005	780		67-66-3	011	1.5 c	0.29 c	0.000053	0.22	0.03				
Chlorobenzene	0.005	1,600		108-90-7	030	1,400 ns	290 n	0.062	0.068	0.07				
SEMIVOLATILE ORGANIC COMPOUNDS (SVOCS)														
Phenol	0.170	23,000		108-95-2	034b	180,000 nm	18,000 n	6.3		5.0				
Chlorophenol,2-	0.170			95-57-8	036	5,100 n	390 n	0.15		0.2				
Dichlorophenol, 2,4-	0.170	230		120-83-2	050	1,800 n	180 n	0.13		0.05				
Naphthalene	0.170	3,100		91-20-3	052	18 c*	3.6 c*	0.00047		4.0	4	20	30	
Trichlorophenol, 2,4,6-	0.170	--	58	88-06-2	058	160 c**	44 c**	0.023		0.008				
Trichlorophenol, 2,4,5-	0.170			95-95-4	059	62,000 n	6,100 n	14		14				
Pentachlorophenol (PCP)	0.330	2,300	5.3	87-86-5	079	0.89 c	2.7 c	0.0017	0.001	0.001				
Phenanthrene	0.170			85-01-8	080									
AROCLORS														
Aroclor-1016	0.033			12674-11-2	119	21 c**	3.9 n	0.092						
Aroclor-1221	0.033			11104-28-2	120	0.54 c	0.14 c	0.00012						
Aroclor-1232	0.033			11141-16-5	121	0.54 c	0.14 c	0.00012						
Aroclor-1242	0.033			53469-21-9	122	0.74 c	0.22 c	0.0053						
Aroclor-1248	0.033			12672-29-6	123	0.74 c	0.22 c	0.0052						
Aroclor-1254	0.033			11097-69-1	124	0.74 c*	0.22 c**	0.0088						
Aroclor-1260	0.033			11096-82-5	125	0.74 c	0.22 c	0.024						
PCBs (Polychlorinated biphenyls) (for EPA RSLs = low risk)	0.033	1.6	0.32	1336-36-3	127	0.74 c	0.22 c	0.078	0.026					
DIOXINS / FURANS														
TCDD, 2, 3, 7, 8 (Note: MT background =0.0000037 mg/kg)	0.000001		0.0000043	1746-01-6		0.000018 c	0.0000045 c	0.0000026	0.000015					
TCDF, 2, 3, 7, 8	0.000001		0.000043	51207-31-9										
Pentachlorodibenzofuran, 2,3,4,7,8- 2,3,4,7,8-PeCDF	0.000005		0.000043	57117-31-4	171	0.000044 c	0.000012 c	0.00000047						
INORGANIC ICP/AES (CRDL) 1/2010														
Arsenic	1	23	0.43	7440-38-2	203	1.6 c	0.39 c*	0.0013	0.29	1.0				
Cadmium	0.5	39		7440-43-9	206	800 n	70 n	1.4	0.38	0.4				
Asbestos				1332-21-4	225									

CRQL Contract Required Quantitation Limit (organic analytes).
CRDL Contract Required Detection Limit (inorganic analytes).
CLP EPA Contract Laboratory Program.
 Lower than CLPContract Required Quantitation Limit (CRQL).
SCDM Superfund Chemical Data Matrix
RDSC Reference Dose Screening Concentration
CRSC Cancer Risk Screening Concentrations.
ICP-AES Inductively Coupled PlasmaAtomic Emission Spectroscopy
PRG Preliminary Remedial Goals
RBCA Risk-Based Corrective Action
SSL Soil Screening Level
* Check the Web site listed with the references forRBSLs for other depths to groundwaterand for C5-C8 Aliphatics, C9C12 Aliphatics, C9C10 Aromatics, C9C18 Aliphatics, C19C36 Aliphatics, and C11C22 Aromatics

** The best achievable practical quantitation limit (0.33 is greater than the RBSL; therefore, if the compound is detected, additional evaluation may be necessary.
DAF Dilution Attenuation Factor
c Cancer
SL Screening Level
c* where: $n \text{ SL} < 100X \text{ c SL}$
c** where $n \text{ SL} < 10X \text{ c SL}$
s Saturation limit- concentrations may exceed Csat (soil saturation limit) (See EPA RSLs User's Guide)
m Theoretical ceiling limit- concentration may exceed ceiling limit (See EPA RSLs User's Guide)
n Noncancer

Sources: EPA 2004 (SCDM); EPA 2002 (SSLs Generic); EPA 2011 (EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites(RSLs)); EPA 2008 (CLP limits); Montana DEQ2009 (Montana Tier 1 RBCA Default RBSLs).